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CONTENTS

OF

THE NAUTILUS, XLIII.

INDEX TO AUTHORS

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THE PLEUROCERID FAUNA OF THE FALLS OF THE OHIO

BY CALVIN GOODRICH

The material for this study has been a collection of Pleuroceridae, now the property of the Museum of Comparative Zoology, that was made by Dr. Richard Ellsworth Call in the early Nineties of the last century. It has been possible, having such quantities, to trace the changes from the very young to the battered and eroded stage which in these mollusks is the frequent condition of the very old; to examine intermediates that connect forms which have seemed to be far apart; to speak with positiveness as to the synonomy.

The waters of the Falls, which are in fact rapids and not falls, pour over rocks of the middle Devonian "by a thousand different passages" (McMurtrie, 1819). As in the case of Muscle Shoals of the Tennessee River, the Falls have admirably suited the requirements of a Pleurocerid fauna—to judge by its numbers—and as the details of environment vary extremely in the course of a few miles of river, the variations in the animals may be assumed to be a response to these conditions, though which particular situation causes particular variations in the mollusks is, of course, unknown.

The locality was of high importance in the pioneer military, political and commercial development of the Mississippi Valley. That history began with the building of a stockade on Corn Island, the nucleus of Louisville, by

George Rogers Clark. Explorers and naturalists came that way at an early day because the Falls were upon the most feasible of the three great routes between the seaboard and the Mississippi. In instances the travelers were compelled to wait there for higher levels of water or to change from one form of water transportation to another. Rafinesque was at the Falls in 1918, and no doubt at later times. Thomas Say came by 1819 with Major S. H. Long's expedition to the Rocky Mountains and passed the Falls again on the journey home, returning with the founders of the New Harmony Utopia in 1825. LeSueur and Troost were members of this latter party. Audubon lived at Hendersonville, now Henderson, about one hundred miles by stream below the Falls. Dr. W. H. DeCamp appears to have been located at Louisville for a while during his service with the Federal armies. In more recent years, collections were made on the rapids by A. C. Billups, A. A. Hinkley and Lorenzo E. Daniels in addition to those of Dr. Call.

Rafinesque supplied a catalogue of local fishes and mollusks for Henrico McMurtrie's "Sketches of Louisville and its Environs", 1819. Seven river univalves were listed, two of which, *Strepoma angularis* and *S. concolor*, were doubtless meant for Pleuroceridae. The description of the genus was never published and the species are unrecognizable. In the same indeterminata are Rafinesque's *Ellipstoma gibbosa* and *E. rugosa*, also assigned to the Ohio River. Of seven species of Pleuroceridae here considered which Say mentions as of the Ohio and its tributaries, four were taken while he was on his journey to the Rockies, three apparently while he was moving to the country of the Wabash. He was responsible for three, and it may be only two, of more than thirty synonyms of the four species found at the Falls. In 1863, Lea described three species from eight specimens that were sent to him by Dr. DeCamp. All had been previously named. The species are here dealt with in detail:

LITHASIA OBOVATA (Say).

Melania obovata Say, New Harmony Dissem., II, Sept. 9, 1829, p. 276.

Original description: "Shell subovate, dark brown or blackish; volutions nearly five: spire remarkably rounded, short: body whorl with a very obtuse, slightly indented band or undulation a little above the middle: aperture more than twice the length of the spire, narrow: labium polished, with a callus above: labrum not projecting near the base, subrectilinear from the shoulder to the basal curve, very convex at the shoulder; base rounded and without indentation.

"Animal—Foot rounded, or rather longer than wide, equally rounded before and behind; above yellowish-white, lineated with black lines.

"Inhabits Kentucky River, and some other tributaries of the Ohio. Length, three-fourths; breadth, nearly half an inch. Var. a. Indented band almost obsolete.

"The spire, and even a part of the body whorl in old shells, are sometimes remarkably eroded, as in *M.* (*Anculosa*) *praerosa*, nob., and, indeed, the general appearance is such that at a little distance, and without particular observation, it might be readily mistaken for that shell; but the form is less globular and the aperture is altogether different. I found it very abundant in Kentucky River, in company with that shell and other species of Melania. I also observed it at the Falls of the Ohio. Lesueur and Troost obtained specimens in Fox River of the Wabash. When young, the undulation is hardly visible, and the shell is often of a dull yellowish color, which on the larger volutions becomes gradually of the characteristic color." (Say).

This Lithasia is so variable that between 1841 and 1863 twelve forms of it were described as distinct species. The variability is much greater in the specimens from the Falls of the Ohio than in those seen from the Kentucky River, the locality of Say's description. Thus, in one lot in the Call collection, consisting mostly of adults, only slightly

more than 20 per cent by count have the typical characters. The rest, a little less than 80 per cent, are slender forms. A mature shell measuring 18¾ mm. by 9½ mm. has slightly shouldered whorls, without constriction. Texture is coarse and lacks pronounced sculpture, the growth lines are irregularly spaced. The aperture is elongate-ovate, a little produced at the base. The columella is white, thick, with a deposit of callus at the top; the outer lip is straight, i. e., not sinuous. A stout specimen is like the foregoing except that the spire is much shorter, the shell has a ventricose appearance and the aperture, because of the shortened spire, seems much larger. A few shells of this lot are constricted on the body whorl.

Specimens from the Ohio River at Charlestown Landind, Indiana, are all of the robust form, having a heavy callus at the angle of the aperture, a produced base and occasionally the constricted body whorl. Some have the revolving, raised line on the top of the apical whorls which, in certain of the Green River colonies, is virtually constant.

Walker (1900) describes the changes in the growth of *obovata*. "At about the beginning of the third whorl, a sharp carina is developed on the periphery of the body whorl, which rapidly increases in strength for the next four whorls. During this stage the junction of the lip with the body whorl is beneath the carina * * *. At about the beginning of the fifth whorl, the lip ascends and crosses the carina, and from thence, until it finally disappears altogether, the carina emerges from the upper part of the aperture. This change in the relative position of the lip and carina induces a radical change, not only in the shape of the lip, but of the whole shell. The lip, in order to clear the carina, becomes broadly rounded above and curves in rapidly to meet the body whorl at almost a right angle, forming a deep channelled suture, while the body whorl becomes more ventricose, more or less shouldered, and rapidly increases in size. * * * With the disappearance of the carina, the shell rapidly assumes its mature form

and, with the usual erosion of the apical whorls, becomes the short, stout, heavy specimen customarily seen in collections."

Call (1896) says that *obovata* is "one of the most abundant strepomatid shells found here (Falls of the Ohio). It may be found in the greatest number on the shallow flats, where it thrives on the confervid growths. It is the sole representative of the genus on the Falls; owing to the conditions of its habitat it does not attain so great a size as in localities where the waters are more quiet." Again, (1900), he says, "At the Falls, where I have collected four or five gallons of them, most are honey-yellow, and many greenish yellow, bright and clean. Fully one-half of the day's collecting with scoop-net, which would result in a couple of bushels of shells, would prove to be this species."

The species is particularly common in the Green River and its tributaries. It occurs in parts of the Wabash drainage, the Scioto River, the upper Ohio and Alleghany Rivers in Pennsylvania. Certain peculiar shells of the Blue River of southern Indiana have the characteristics of *obovata* in detail, though their general appearance is that of the genus Goniobasis. I am inclined to think that the *Melania sordida* Lea, 1841, occurring in parts of Central Tennessee, is also one of the variations of this plastic species.

Goniobasis depygis (Say) has been so common a name in the literature of the Pleuroceridae it is with regret that it is consigned to the synonomy of *L. obovata*. It was described during the time that hardfast and clearly cut lines were supposed to demark forms of life, the one from another. Also, at the time, no one grasped the fact that variableness among the American Melanians was the rule and not the exception. Mr. A. A. Hinkley directed my attention to the true position of *depygis*. His view I have found many times confirmed. Say in his own description speaks of the columella as having "a calcareous deposit, particularly above." That deposit is one of the usual characters

of the Lithasias and has been spoken of by Call as a "conchologic constant", and this so far as the Lithasia on the Falls is concerned is true. The two lower figures of Plate 8 of "Descriptions of some new Terrestial and Fluvatile Shells of North America", which supposedly Say himself had taken, are of such young shells that it seems possible he did not collect the mollusks in such numbers as might have shown him the connection between *obovata* and *depygis*. Call (1900) says, "In the little crevices in the flat rocks, at low water, which alone contain running water, this shell congregates by thousands and may be collected by the handfuls. In this way I secured in 1893 over a peck of the small Strepomatids, the mass of the material being this little species." In every essential character, ignoring deceptive differences in shape, "this little species" of the crevices links up with the ventricose *obovata*.

Call (1896) makes *Goniobasis infantula*, *louisvillensis* and *informis*, all of Lea, the synonyms of *depygis*. Later (1900), he decides to recognize *infantula* as distinct. The specimens of *infantula* that I have seen are young, probably of *obovata*, but possibly of *Lithasia verrucosa* Raf., a species found both above and below the Falls but not yet reported from the locality though it might very well occur there. *Louisvillensis* lacks only the ventricose character of typical *obovata* to be easily identified as that species. *Informis* I take to be one of the freakish forms that occur in *obovata*, being much like Anthony's *curvilabris* of the Green River. The three species of Lea came to him from Dr. W. H. DeCamp. Of *infantula* he had six specimens and of *louisvillensis* and *informis* two each. The synonomy of *obovata* is:

Melania depygis Say 1829.
Melania gibbosa Lea, 1841.
Melania curvilabris Anthony, 1854.
Melania coronilla Anthony, 1854.
Melania elegantula Anthony, 1854.
Melania undosa Anthony, 1854.

Melania planospira Anthony, 1854.
Melania consanguinea Anthony, 1854.
Melania rarinodosa Anthony (Reeve), 1860.
Goniobasis informis Lea, 1863.
Goniobasis louisvillensis Lea, 1863.
Goniobasis infantula Lea, 1863.

PLEUROCERA CANALICULATUM (Say).

Melania canaliculatum Say, Journ. Acad. Nat. Sci., Phila., Jan., 1821, p. 175.

Original description: "Shell tapering, horn-color, volutions about seven, slightly wrinkled; spire towards the apex much eroded, whitish; body with a large obtuse groove, which is obsolete upon the whorls of the spire, in consequence of the revolution of the suture on the inferior margin; this arrangement permits the superior margin of the groove, only, to be seen on the spire, in the form of an obtuse carina on each of the volutions; aperture bluish-white within, with one or two obsolete revolving sanguineous lines; labrum slightly undulated by the groove, and yith a distinct sinus at the base of the columella.

"Inhabits Ohio River.

"Length 1 1/10 inch. Breadth, ⅗ of an inch. Greatest traverse diameter more than ⅔.

"Very common at the Falls of the Ohio River. It is probably the largest species of this genus in the United States, and may be readily distinguished from its congenera by its broad groove." (Say).

Under the glass, the young of this species are seen to be slightly carinate, stoutly so, or not carinate at all. Specimens with smooth apices are comparatively rare. A faint revolving line may occur on the upper half of the whorl or it may be absent. Numbers of the young have the beginning of the "groove" of which Say speaks. After the eighth or ninth whorl, the new growth may expand suddenly as it does in most *L. obovata*. Also, the fine, regular growth lines become rougher and irregularly spaced,

the surface of the whorl often malleated and marked by dark rest scars. It would seem as if at a certain stage of growth the individuals moved from quiet waters to swifter currents.

The typical adult ordinarily has six or eight whorls, the uneroded remains of from fourteen to sixteen whorls. The epidermis is usually worn thin. The broad constrictions of the body whorl, the "groove" of Say, may be angulated on the inner edges. The periphery is rounded. The bluish-white columella is only a thin wash of callus at the top and a slight projection near its center suggests a plait or twist. The outer lip is slightly outcurved at the suture, then slightly incurved, and projecting at the base. The aperture is rather small, ovate and produced into a sinus. An occasional specimen is angled, hardly carinate, at the periphery. The largest specimen seen in this study is 29 mm. in altitude by 13½ mm. in diameter, the average size of fifteen adults being 25⅖ mm. by 12 mm. plus. Of the shells taken by Call in the Ohio River at Charlestown Landing, Indiana, about twenty miles above the Falls, the largest is 29½ mm. by 13½ mm., and has five and one-half remaining whorls. The average of the largest six specimens is 26¼ mm. by 13 mm. These shells, usually deeply channelled, are much more like one another than are the forms at the Falls. The Lawrenceburg, Indiana, (Ohio River), shells are of about the same size as these, but are much larger whorl for whorl.

Call (1894) lists *canaliculatum* as the only Pleurocera at the Falls. The list is amended (Call, 1895) to *P. canaliculatum* Say, *elevatum* Say and *moniliferum* Lea. In the Memorial History of Louisville, (1896), Call adds *undulatum* Say. In his latest work on the subject (Call, 1900), he deals with the four as inhabitants of these rapids.

The *Pleurocera moniliferum* Lea is a synonym of *excuratum* Conrad, an elongated member of the *canaliculatum* group which is usually distinguished by a row of small, closely set tubercules on the periphery of adult whorls. It

is most common—apparently as a pure strain—in the Tennessee River at Muscle Shoals and is the single Pleurocera I have found in the Tennessee in western Tennessee and Kentucky. It occurs, seemingly as an aberrant, in the Wabash system, the lower Cumberland and the Clinch near its mouth. I have not seen it in the Call collection from the Falls of the Ohio or in any other collection from the locality. *P. undulatum* is included by Call (1896) among the forms that "are very abundant and are found over all portions of the upper two-thirds of the Falls." Later (1900), he says of it that "On the Falls of the Ohio this species is very common, but near Charleston Landing it is abundant." Specimens that can be called *undulatum* are absent from the Call material I have examined.

The case of *P. elevatum* is exceedingly perplexing. Say's description is confusing, particularly in stating that the aperture equals the "length of the second, third and fourth volutions conjunctly", which, as Call points out (1900), "is most certainly not true of this or any other strepomatid." The description further says that *elevatum* is "distinct from our other species, by the elevated revolving lines", referring to *canaliculatum*. Call writes (1895) that "the form called *P. elevatum* itself is a beautiful illustration of the effects of different environment. If taken from swiftly flowing water, and found attached to rocks, the shells are short and stubby, whorls well thickened and with incrassate aperture. The same shells obtained from pools where the water does not flow at all, and where vegetation flourishes in great abundance, are elongate, thinner in texture, thinner about the aperture, have the lines of growth far apart and well marked. These are the points on which the supposed distinct species have been based, but are thus seen to be but a reflex of the conditions of environment." His more recent remarks (Call, 1900) on *elevatum* are that "specimens have been seen from the Ohio at the Falls and from Lawrenceburg. I do not know it from other streams." Unfortunately, none of the Call

shells in the Museum of Comparative Zoology that are from the Falls is differentiated as *elevatum*.

The specimens that in most collections are labelled *elevatum* are simply robust forms of *P. acuta* Raf. Clearly these forms are not of the kind that would be found in such parts of the Ohio River to which Say had access, if in any part it does occur. I am at a loss to say what *elevatum* is, except that it is not what most collectors, myself included, have sometimes thought, namely, a member of the *acuta* group. It may be that Say had some of the odd slender specimens of the *canaliculatum-undulatum* complex which may be seen here and there in extensive collections of some given locality, shells that when separated from others of their colonies betray the unwary student into the erection of species that cannot stand. The synonomy of *canaliculatum* is:

Melania conica Say, 1821.
Strombus sayii Wood, 1828.
Melania exarata Menke, 1830.
Melania ligata Menke, 1830.
Melania auriscalpium Menke, 1830.
Ceriphasia sulcata Swainson,
Melania substricta Haldeman,1844.
Trypanostoma troostii Lea, (part), 1862.
Trypanostoma viride Lea, 1862.
Trypanostoma ligatum Lea, 1862.
Trypanostoma simplex Lea, 1862.

ANCULOSA PRAEROSA (Say).

Melania praerosa Say, Journ. Acad. Nat. Sci., Phila., II, Jan., 1821, p. 177.

Original description: "Shell subglobular, oval, horn color; volutions three or four, wrinkled across; spire very short, much eroded in the old shell, so much so as to be sometimes not prominent above the body whirl; body whirl large, ventricose, with a very obtuse, slightly impressed revolving band; aperture suboval, above acute and

effuse; within on the side of the exterior lip about four revolving purplish lines, sometimes dotted, sometimes obsolete or wanting; labium thickened, particularly at the superior termination near the angle, and tinged with purplish; base of the columella somewhat elongated and incurved, meeting the exterior lip at an angle.

"Length, about ½ inch. Inhabits Ohio River.

"Found in plenty at the Falls of the Ohio. The spire is remarkably carious in the older shells, and the penultimate whirl, between the aperture and spire, is also remarkably eroded in many older shells. The spire in the young is entire, and but little prominent, though acute, and the bands are distinct on the exterior of the shell. This shell does not seem to correspond to the genus to which I have, for the present, referred it; and owing to the configuration of the base of the columella, if it is not a Melanopsis, it is probable its station will be between the genera Melania and Acathina. I propose for it the generic name of Anculosa." (Say.)

The elongation of the columella, "meeting the exterior lip at an angle," that caught the eye of Say is an outward curving and narrowing of the labium, so that the aperture edge of the base is on a plane with the angle of the body whorl as the shell is held flat, aperture upward. This is particularly prominent in the *praerosa* from the Falls of the Ohio. It is so also in shells from the Blue River of Indiana, meaning the one directly tributary to the Ohio, not that of the Wabash system. The feature is no more than a produced point of the base in Cumberland River shells, the same being true of certain lots from East Tennessee that have come to be known as *Anculosa tryoni* Lewis. The character is present, though not conspicuous, in material from the Holston River above Knoxville, in shells from the Elk River, the Flint and the Sequatchie, and in part of the Clinch River where *A. subglobosa* is giving way to *praerosa*. It is scarcely noticeable in the *praerosa* taken in the South Fork of the Holston River at Kingsport, Tenn.,

and is microscopic in Duck River shells collected at Shelbyville, Tenn. Though I have not examined all the *A subglobosa* available, I find a somewhat similar character in specimens of it taken in Big Moccasin Creek near Gate City, Va., and in Laurel Creek, Smyth County, Va., both of the Holston drainage, and absent in Powell River and upper Clinch River mollusks.

Since a flexure of the columella is the generic characteristic of *Eurycaelon* as that genus is restricted by Walker (1918). I have closely compared specimens of *E. Anthonyi* Budd with *A. praerosa* of the Falls. The principal differences are herewith noted:

	Anculosa	Eurycaelon
Columella	spreads broadly over umbilicus	much narrower than in *praerosa*
Shoulder	usually smooth	usually lumpy
Outer lip	sinuous	not sinuous
Basal angle of columella	raised to plane of shell	usually with a depression beneath.

In one lot of the Call shells, thirty-three specimens in all, four rather distinct forms could be separated. (1) Comparatively elongate and without constricted whorls, the largest measuring 20 mm. in altitude by 17 mm. in diameter. Seventeen shells. (2) Of a globose appearance, body whorl rounded, not flattened or constricted. Largest 20 mm. x 17½ mm. Seven shells. (3) Body whorl so flattened as to give the shell a "squared" appearance. Largest, 17¾ x 16½ mm. Five shells. (4) Noticably constricted. Largest, 17½ mm. x 15 mm. Four shells. Of forty small, partly grown shells, the proportions of the largest five averaged 15.65 mm. by 13.25 mm., the smallest five, 9.05 mm. by 7.85 mm.

Individual variation in color bands is extreme. The commonest formula is four equidistant bands which may be complete, broken into squares, oblongs, or dots, or may consist of hair-like lines.

The very young of *praerosa* are bicarinate and very

nearly as wide as they are high. They carry no suggestion of the adult form. Dr. Lea gave these juveniles the name of *Melania cincinnatiensis*. Dr. Lewis (1870-71) identified *cincinnatiensis* as the young of *A. tintinnabulum* Lea and pronounced the latter—which had been thrown by Tryon into the synonomy of *A. subglobosa*—a good species. Tryon (1871) stuck to his decision. Dr. Walker, in a very interesting paper (1908), reviewed the case and came to the conclusion that *cincinnatiensis* is the same as *praerosa* and that *tintinnabulum* is entitled to full specific rank. I think *tintinnabulum* is closely related to *praerosa*. In places in the Holston River it occurs as "pure" colonies and in other localities of the same system it is to be found as one of possibly several forms of *praerosa*. Dr. Lewis (1870-71) mentions that Mr. U. P. James has collected *tintinnabulum* in the Ohio River. I think it quite likely that it may occur there in the way it does in the Holston, i. e., as a locally restricted race. When it becomes possible to examine large series of the Anculosa of one of our river systems, from headwaters to mouth, the forms of such a species as *A. praerosa* may be discovered to bear some relation, wherever they occur, to the character of the stream.

Call, in the Memorial History of Louisville (1896), says that *praerosa* "is not uncommon, but may be found in numbers in the deeper and more swiftly flowing waters, clinging to the rocks." Later (1900) he writes, "This large anculosid is very common on the Falls, at Louisville, and may be taken in great numbers at very low water, clinging to the flat rocks in swiftly running water. Very large examples were collected abundantly in 1893-94."

The known distribution of *praerosa* is: Ohio River, Cincinnati to Golconda, Ill.; Blue and Wabash Rivers, Indiana; Cumberland River, Burnside, Ky., to below Nashville, Tenn.; Obey River, Tenn.; parts of Clinch and lower Holston Rivers, Tenn.; French Broad River, Tenn.; Tennessee River, Knoxville, Tenn., to Muscle Shoals, Ala.; Little Tennessee River, Tenn.; Little River, Tenn., near its mouth;

Sequatchie and Little Sequatchie Rivers, Tenn.; Battle Creek, Tenn.; Duck River, Tenn.; Flint and Paint Rock Rivers, Cypress, Shoals and Bluewater creeks, all of Alabama; Elk River, Tennessee and Alabama. The synonymy of *praerosa*:

Melania angulosa Menke, 1828.
Melania cruentata Menke, 1828.
Melania ovularis Menke, 1828.
Melanopsis neritiformis Deshayes,
Anculotus angulatus Conrad, 1834.
Melania cincinnatiensis Lea, 1838.

ANCULOSA TRILINEATA (Say).

Melania trilineata Say, New Harmony Dissem., II, Sept. 9, 1829, p. 277.

Original description: "Subglobose, oval, yellowish, more or less tinged with brown: volutions about four, rounded, somewhat wrinkled: spire short, rather more than half the length of the aperture: suture not very deeply impressed: body whirl with three brownish black revolving lines, of which the two inferior ones are somewhat nearest together, the middle one widest and the superior one placed near the suture and revolving on the spire; the middle one is concealed on the spire, by the suture: aperture much dilated, ovate, acute above: labium a little flattened: labrum widely and regularly rounded, without any protusion near the base: base slightly angulated, without any sinus or undulation: umbilicus none.

"Inhabits Falls of the Ohio. Length, less than half an inch. Var. a. Inferior band obsolete. Var. b. Bands obsolete.

"This species is allied to the preceding [*Melania isogona*, a Somatogyrus], but is obviously distinct in its general appearance; the volutions are destitute of a shoulder, and the aperture is ovate, acute above. It is a pretty shell, the bands being very conspicuous, strongly contrasting with the yellow general color, particularly in the young and half grown shell.

"I obtained about a dozen specimens on the rocky flats of the Falls of the Ohio, at the lower end of the island which is nearest to Louisville." (Say).

It will be observed that emphasis has here been put on bands and color. These are likely to be uncertain characters in the Pleuroceridae and, though useful sometimes in helping to give a clue to the identification of a species or to its relationship, they should not be considered of primary importance. Taking one hundred specimens of Call's *trilineata* at random I found that seventy-seven were without color bands at all. Of the twenty-three with bands, only six are of the formula described by Say. Seven other formulae occurred, of which one of a fairly wide band at the periphery and a narrow one at the base was the commonest. Specimens of a clear green color—probably deeper in the freshly collected shells than in those that have been exposed long to the light—were named *Melania viridis* by Lea. Tryon made it a synonym of *trilineata*.

The nuclear whorls of *trilineata*, 1¼ turns, are perfectly smooth, as in most instances are the whorls that come after. But some of the young in the post-nuclear stage are singly carinate, doubly carinate or angled at the periphery. The columella is white, yellowish-white or purple, straight in the center, angled at the base and slightly indented at the umbilicus. In the old, the columella is likely to be thickened at the top. The largest specimen noticed in this study was 13½ mm. in altitude and 10½ mm. in diameter. The average of twelve robust specimens was 11½ mm. by 9¼ mm.

Tryon (1873) declined to agree with Haldeman, Brot and Jay that *costata* Anthony was synonymous with *trilineata*. He says that *A. trilineata* "is never costate and has three broad, brown bands, and Mr. Anthony informs me that it has never been found in the upper Ohio River, while *costatus* is plentiful at Cincinnati." A number of costate specimens were found among the Call shells from the Falls. They differed in no regard from the common *trilineata* ex-

cept in the matter of having raised revolving lines around the whorls. Examining material from Cincinnati that was labelled *costata* I found in one lot that one specimen in four was carinate, the other three being smooth; in another lot that sixteen had from one to several costae and six were simply angled at the periphery. A third lot, labelled "Ohio River", consisted of fourteen costate shells and fifteen smooth. It seems possible to say of the species that in most colonies costate forms occur without respect to age or size and that—as appears from specimens taken in Five Mile Creek, Campbell County, Ky.,—all specimens may have this characteristic. I have come upon several instances among the Pleuroceridae in which a minor character, rare in one colony of a species, may be present in virtually all members of another colony of the same species.

Tryon (1873) ventures the opinion that *trilineata* is not an Anculosa. "Its small size and smooth surface and general outline," he says, "suggest its pertinence to the Amnicolidae, to which family several small species, hitherto considered to be Anculosae, have been recently removed." Doubts of the sort disappear upon a comparison of the texture, sculpture and opercula of the two groups. The synonymy of *A. trilineata* is:

Anculotus costatus Anthony, 1840.
Melania occidentalis Lea, 1841.
Melania viridis Lea, 1841.

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SOME NEW LIGUUS FROM THE FLORIDA EVERGLADES

WILLIAM J. CLINCH

The new color forms of *Liguus* described here are to be followed later by a more comprehensive paper dealing with the derivation of these and other forms in the central Everglade region.

LIGUUS CRENATUS BARBOURI, nov. subsp.

Shell: large, subsolid, rather elongate, polished. Whorls seven, rather convex. Tip of spire white (two whorls). Columella white, occasionally truncated, slightly twisted. Palatal lip emarginate, parietal wall calloused. Color whitish to yellow as a ground with the following arrangement of superimposed colors. A very narrow sutural line of white or yellowish bordered superiorly and inferiorly with a band of very dark brown or black usually as a solid band 1 to 4 mm. in width. A band also exists about the central area of the body whorl. Occasionally the bands are broken into a series of dots or squares usually on the last two whorls. Areas on the whorls between the bands are mottled with gray blue and yellowish or whitish. A very few specimens have the body whorl near the palatal area almost entirely blue black. Basal area gray blue to blue black, region bordering columella banded usually with yellowish just within a band of bluish black. Narrow green spiral lines usually present though not readily perceived in the darker forms.

Sculpture consisting of very fine growth lines, rather regularly spaced slightly increasing in size on the later whorls.

Length	Width	Ap. length	Ap. width
51.5	27	24	14.5 mm. Holotype

Holotype: M. C. Z. 84527. Pinecrest region, central Everglades, Fla. Hammock no. 21 (Farnum number). J. N. Farnum, collector.

Remarks: Found in nearly all the hammocks of the Pinecrest region.

LIGUUS CRENATUS FARNUMI, nov. subsp.

Shell: medium to large, rather elongate, rather thin, polished. Whorls seven, slightly convex. First three whorls of spire white. Columella white, twisted and in a few specimens more or less truncated. Palatal lip slightly emarginate. Parietal lip thinly calloused inclined to show pinkish due to the dilution of the brown red color underneath, *not due to special* reddish pigmentation as in the *L. fasciatus* group. Sutural area whitish. Color *pattern* similar to *L. c. barbouri*, color bands of a rather dark mahogany red, areas between of mottled yellow or whitish, and lighter mahogany red. Basal area usually much darker, equalling the color of the juxtasutural bands. Area along the columella sometimes a decided brick red. Spiral line present, those above the middle of the body whorl more intense. Sculpture of fine, regularly spaced growth lines.

Length	Width	Ap. length	Ap. width
47.	25.	23.	13 mm. Holotype

Holotype: M. C. Z. 84586, Pinecrest region, Central Everglades, Florida. Hammock no. 7, (Farnum number). J. N. Farnum, collector.

Remarks: Known only from a single small hammock which is now partially destroyed by fire.

LIGUUS CRENATUS AURANTIUS, nov. subsp.

Shell: Large, solid, slightly elongate, polished. Whorls seven, quite convex, first three or four whorls of spire white. Columella white, twisted, continuous or truncated. Palatal lip emarginate, acute, parietal wall calloused, white. Color very light orange on the fourth whorl, gradually increasing in intensity to a very deep orange in most specimens on the palatal area of the body whirl. This is a wash of color covering the entire whorl though bands of deeper intensity are produced juxtasuturally and on the central area of the body whorl. From few to several green spiral lines are found, more intense above the middle of the whorl. Sculpture of exceedingly fine growth lines.

Length	Width	Ap. length	Ap. width
51.5	29	24	15 mm. Holotype

Holotype: M. C. Z. 84624, Pinecrest region, Central Everglades, Hammock no. 408 (Clench number), Clench and Lermond, collectors. Paratypes M. C. Z. nos. 84016 and 84397. The last collected by J. N. Farnum from the same hammock (Farnum hammock, number 5).

Remarks: C. T. Simpson (1920 Proc. Biol Soc. Wash., Vol. 33, p. 123) described *L. c. luteus* as "pale yellow to orange." With the material now at hand it seems best to limit *L. c. luteus* to the yellow forms, *L. c. aurantius* named for the orange colored phase. There is no question but that we are dealing with two distinct color races which only occasionally show hybridization. The holotype of *aurantius* was selected from a pure race of this form, no other color form being found on this hammock by Farnum, Clench, Lermond or Allen. Pure races of *L. c. luteus* are quite abundant in the vicinity of Homestead and Royal Palm Park, Florida.

LIGUUS CRENATUS FLORIDANUS, nov. subsp.

Shell: medium to large, globose to elongate, not very solid, polished. Whorls seven, strongly convex. First three to four whorls of spire porcellaneous white. Columella white, occasionally truncated, moderately twisted. Palatal lip emarginate, parietal wall thinly calloused. Ground color amber yellow, rarely whitish. Color pattern as in *L. c. barbouri* and *L. c. farnumi*, the bands mahogany red, mottling either of brownish or gray blue. The mottling color is not well developed, the ground color is decidedly predominating. A bar of brownish or brownish orange is found bordering the columella. Sculpture of only very fine growth lines. Spiral green lines as in other forms.

Length	Width	Ap. length	Ap. width
49.	27.5	23.5	14.5 mm. Holotype

Holotype: M C. Z. 84559, Pinecrest region, Central Everglades, Hammock no. 8 (Farnum hammock number). J. N. Farnum, collector.

Remarks: A form more or less intermediate in coloration between *L. c. barbouri* and *farnumi* though exhibiting several characters more or less peculiar to itself. It is far more globose than any other form found at Pinecrest and possesses comparatively little mottling of color between the bands of mahogany brown.

Pinecrest is the remnant of a road construction camp established during the construction of the "Tamiami Trail", and today consists of a few houses, a store, and a series of tomato farms. Pinecrest is 46 miles nearly due west of Miami. With two exceptions, all collections were made in hammocks within an area of 7 mi. E of Pinecrest. The two exceptions are a small hammock ¼ mi. W and another about 3 mi. SW.

The subspecies herein described were based upon material collected by J. N. Farnum, of Miami, Florida, whose large collection is now possessed by the Museum of Comparative Zoology, and upon collections made by N. W. Lermond and the writer during the latter part of February and the first of March of this year.

SOME PREVIOUSLY UNPUBLISHED FIGURES OF TYPE MOLLUSKS FROM CALIFORNIA

BY LIONEL WILLIAM WIEDEY

A number of species of marine mollusks from the Cretaceous and Tertiary strata of central California have been briefly described, but not figured, by E. B. Hall and A. W. Ambrose.[1] These species were collected in the Mount Hamilton Range and adjoining ranges on the eastern side of San Francisco Bay.

It is generally recognized that the practice of describing species without their being figured is to be severely condemned. Moreover, such an unfortunate procedure im-

[1] Nautilus, Vol. 30, No. 6, 1916, p. 68; No. 7, 1916, p. 77.

pedes the further scientific progress in this direction of all but those few to whom the types are available. Since species so described are considered to have recognized standing, the writer believes it essential that the descriptions of these species be completed by making available figures of them, inasmuch as they, in their present status, are nearly valueless to those who study marine faunas from this region of the ages represented by these unfigured forms.

Enlargement upon the original brief descriptions and discussions is not here undertaken. The figures will suffice to permit subsequent writers to make such disposition of them as they deem expedient. However, notes kindly furnished by Mr. F. M. Anderson on some of the Cretaceous species are incorporated in full. The types are in the Paleontology Collection of Stanford University.

New type numbers and new locality numbers have been given each of the forms described by Hall and Ambrose in order to conform with other species described from the Stanford collections in the Department of Geology.

AVICULA GREGORYI Hall and Ambrose, Pl. I, fig. 1.

Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 6, 1916, p. 69.

The type of this species was collected from Horsetown strata, middle Cretaceous, at a locality one and one-half miles south and a little west of Carnegie, Tesla quadrangle.

OSTREA TITAN Conrad, var. PERRINI Hall and Ambrose. Pl. III, fig. 1.

Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 80.

This form was declared to occur abundantly in the Briones formation, middle Miocene, in the Tesla, Pleasanton, San Jose, and Mt. Hamilton quadrangles.

PECTEN CLARKENSIS Hall and Ambrose.[1] Pl. II, fig. 3.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 6, 1916, p. 68.

This very small specimen was collected at a locality two and one-half miles northeast of the town of Milpitas, San Jose quadrangle, in Horsetown beds, middle Cretaceous.

PECTEN TOLMANI Hall and Ambrose. Pl. I, fig. 2.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 82—Trask, P. D., Univ. of Calif. Publ., Bull. Dept. Geol. Sci., Vol. 13, No. 5, 1922, p. 139, etc., pl. 3, figs. 1 and 3.

This species was stated to have been collected in the Briones formation, middle Miocene, in the Tesla, Pleasanton, San Jose, and Mt. Hamilton quadrangles. At a somewhat later date Trask found this species to be quite characteristic of the Briones formation. Another statement in the original description adds that its horizon is probably Monterey, lower Miocene. The work of subsequent writers seems to have demonstrated that the designation of the Briones as its horizon was the correct one.

PHOLADOMYA HARRIGANI Hall and Ambrose. Pl. I, fig. 5.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 77.

Mr. F. M. Anderson declares that "this form is notable for its close resemblance to an undescribed form found at Horsetown, Shasta County, which is a distinct species of smaller size, with finer ribs on the anterior half of the shell. The otherwise close resemblance may be taken as indicating stratigraphic difference. But in view of the fact that its horizon is not far removed from that of *Schloenbachia templetoni*, it seems probable that it should be regarded as a lower Chico form."

[1] Hanna (Proc. Calif. Acad. Sci., 4th Ser., Vol. 13, No. 10, 1924 p. 176) suggested this name might be preoccupied but the differences in spelling in the two species names involved clearly eliminates that possibility.

This species was said to have been collected in upper Chico, upper Cretaceous.

MACOMA WILCOXI Hall and Ambrose. Pl. I, fig. 4.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 81.

This species was declared to have been secured in the Briones formation, middle Miocene, in the Tesla quadrangle, near Livermore and near Dublin.

MACTRA BEALI Hall and Ambrose. Pl. I, fig. 3.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 80.

This species of *Mactra* was said to have been collected from the Monterey sandstone, lower Miocene, in the Pleasanton quadrangle.

MESODESMA PACIFICA Hall and Ambrose.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 79.
Myadesma pacifica (Hall and Ambrose), Clark, Bruce L., Univ. of Calif. Publ., Bull. Dept. Geol. Sci., Vol. 14, No. 4, 1922, p 118, pl. 13, fig. 5.

This unusual species was one of a group of three which Clark later chose to represent his new genus *Myadesma*. The type of the species was collected from the Monterey sandstone, lower Miocene, in the Pleasanton quadrangle, near the town of Sunol. The new type number is 513, and the new locality number is 813.

PANOPEA SMITHII Hall and Ambrose. Pl. II, fig. 1.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 79.

This species was collected from the Tejon, upper Eocene, in Corral Hollow, near Livermore, in the Tesla quadrangle.

ATAPHRUS PEMBERTONI Hall and Ambrose. Pl. I, fig. 7.
Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 6, 1916, p. 70.

This small form was declared to have been collected from the Chico formation, upper Cretaceous, in the Arroyo del Valle, Tesla quadrangle.

CERITHIUM ? TESLAENSIS Hanna. Pl. I, fig. 6.

Cerithium branneri Hall and Ambrose, Nautilus, Vol. 30, No. 6, 1916, p. 70. NOT *Cerithium branneri* White, Arch. Mus. Nat. Rio de Janeiro, Vol. 8, 1887, p. 153.

Cerithium ? teslaensis Hanna, Proc. Calif. Acad. Sci., 4th Ser., Vol. 13, No. 10, 1924, p. 162; new name proposed.

Cerithium branneri was said to have been collected from the Chico formation, upper Cretaceous, one mile north-northwest of Tesla and Corral Hollow, Tesla quadrangle.

SONNERATIA ROGERSI Hall and Ambrose. Pl. II, fig. 2.

Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 6, 1916, p. 69.

Mr. F. M. Anderson remarks about this species that "an examination of the holotype of this species proves it to be a form nearly allied to, but also distinct from, *Sonneratia stantoni* from the upper Cretaceous of Horsetown, Shasta County, California. In the description of the species the suture is not mentioned, but on the specimen itself it can be seen, and the septation differs in no important respects from that of *S. stantoni* as shown in the Proc. Calif. Acad. Sci., Vol. 2, 1902, pl. 10, fig. 198. I am disposed to think that this horizon is near the top of the Horsetown group."

The specimen was originally declared to have been collected from the Horsetown, middle Cretaceous.

SCHLOENBACHIA TEMPLETONI Hall and Ambrose. Pl. II, fig. 4.

Hall, E. B., and Ambrose, A. W., Nautilus, Vol. 30, No. 7, 1916, p. 78.

Concerning this species, Mr. F. M. Anderson remarks that "this form is worthy of especial notice on account of its size and form. No dimensions of the holotype are given in its description, except the diameter of the last whorl,

which is 160 mm. This is somewhat below the facts, although the specimen is a little crushed and the diameter thereby increased. The ratio of the diameter of the whorl to that of the umbilicus is about 3.7:1. In respect to this ratio, as well as in the character and number of the ribs, and in other features (not including the septa) the form approaches very near to *Schloenbachia propinqua* (Stoliczka) from the Ootatoor group of southern India. As far as the septa on the California species can be seen, the resemblance holds true. The horizon from which the sample was obtained is probably the lower Chico, rather than the upper Chico as stated by the authors."

DESCRIPTION OF TWO NEW SPECIES OF MOLLUSCS FROM THE WEST COAST OF NORTH AMERICA

BY G. WILLETT

TURBONILLA (STRIOTURBONILLA) CAYUCOSENSIS, new species. Pl. 3, figs. 2, 3.

Shell large, broadly elongate-conic, bluish-white in younger specimens, yellowish-white in adults. Nuclear whorls small, rounded, having their axis at right angles to the succeeding turns. Post-nuclear whorls somewhat flattened and shouldered at the summits. Surface marked by heavy, rounded, closely spaced, strongly protractive axial ribs, of which fourteen occur on each of the first eight whorls, sixteen on the ninth and tenth, eighteen on the eleventh, and twenty on the twelfth and last whorl. These ribs extend from the summit of the whorl to the periphery, where they merge and terminate. Intercostal spaces a little narrower than the ribs, also terminating at the periphery. On the type and other adult specimens the axial ribs extend over the base, becoming more or less feeble and uneven on the anterior portion. In immature specimens (ten whorls or less) the ribs terminate at the periphery. Entire

base and spire covered with fine spiral striations, visible only under a fairly strong lense. Aperture oval, posterior angle narrowly, obliquely truncated by the flattened summit. Outer lip thin, slightly contracted; inner lip slightly oblique and somewhat reflected. The type has twelve postnuclear whorls and measures:—Length, 9 mm.; diameter, 2 mm.

The type, No. 1016, Collection Los Angeles Museum, and 24 additional specimens were taken by Mr. H. N. Lowe under stones on the beach at Cayucos, California, June, 1927. Paratypes are in the collections of the U. S. National Museum, Philadelphia Academy of Natural Sciences, H. N. Lowe, and the writer.

Remarks.—In general shell characters this species seems to resemble *T. attrita* Dall and Bartsch. It is easily differentiable from this species, however, by its larger size, as well as by its more protractive and different number of ribs. A study of the type series shows some individual variation in the width of the ribs and in their number. While most of the specimens are like the type in the latter character, in some specimens the increase in number of ribs occurs one whorl earlier.

LEPTOTHYRA ENGBERGI, new species. Pl. 3, fig. 4.

Shell small, globose, solid, either perforate or imperforate; whorls convex, marked by thread-like spiral riblets which are rendered minutely nodulous by the intersection of the growth lines. On the last whorl there are about thirty of these riblets. Aperture about half the height of the shell, almost circular, white to bluish-white within. Outer lip rather thin; inner lip thickened. Columella arcuate, flattened, without teeth. Color of shell dark brown to dull black in unworn specimens. Operculum of several whorls, shelly, concave, with nucleus a little anterior to the center and considerably nearer to the columella than to the outer lip. Alt. 3.3 mm. diam. 3.2 mm.

Type No. 1017 Collection Los Angeles Museum. Paratypes in collections of Dr. Engberg and the writer. The

type and many additional specimens were collected by Dr. Carl C. Engeberg at Olga, Washington, and it is in honor of this well known collector that the species is named.

Remarks.—This well marked little shell is perhaps nearer to *L. bacula* Cpr. than to any other known species of west American Leptothyra. It differs markedly from this species, however, in much smaller size, difference in coloration, lack of columellar teeth, and in the fact that it is often perforate. Of twenty-eight specimens sent in by Dr. Engberg, twenty are perforate in greater or less degree, and the remaining eight imperforate.

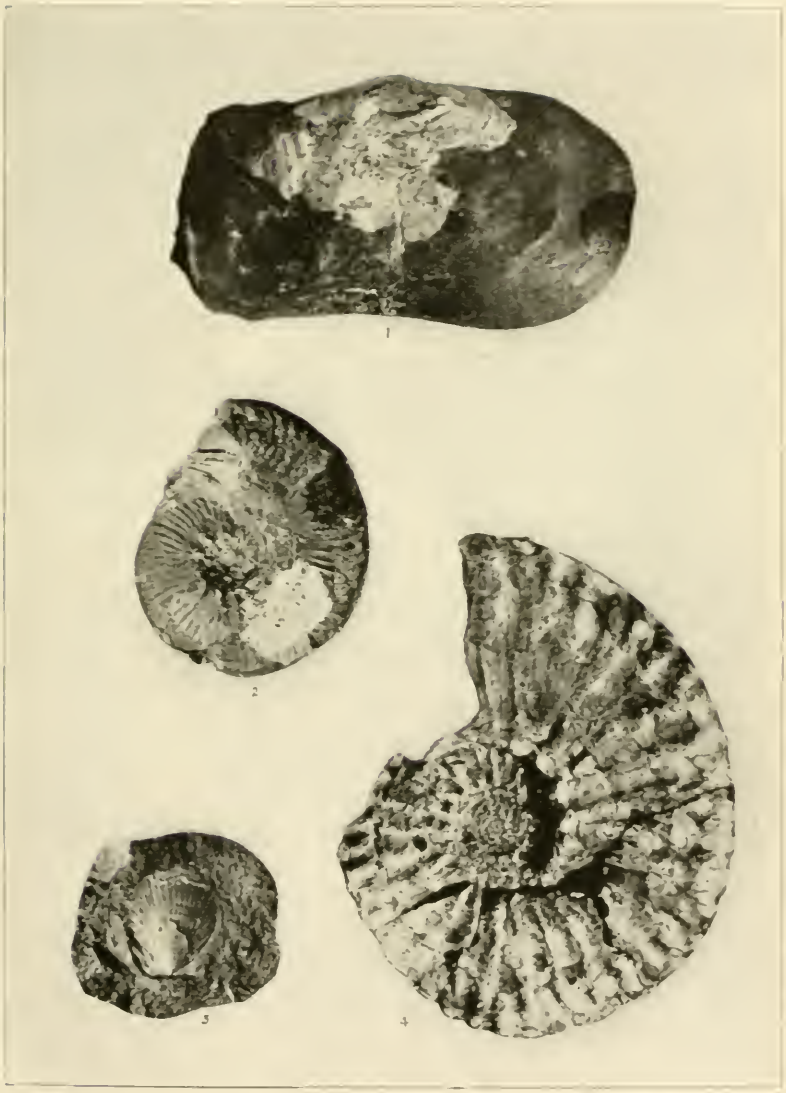
Los Angeles Museum, Los Angeles, California.

FURTHER NOTES ON DONAX FOSSOR AND DONAX VARIABILIS SAY

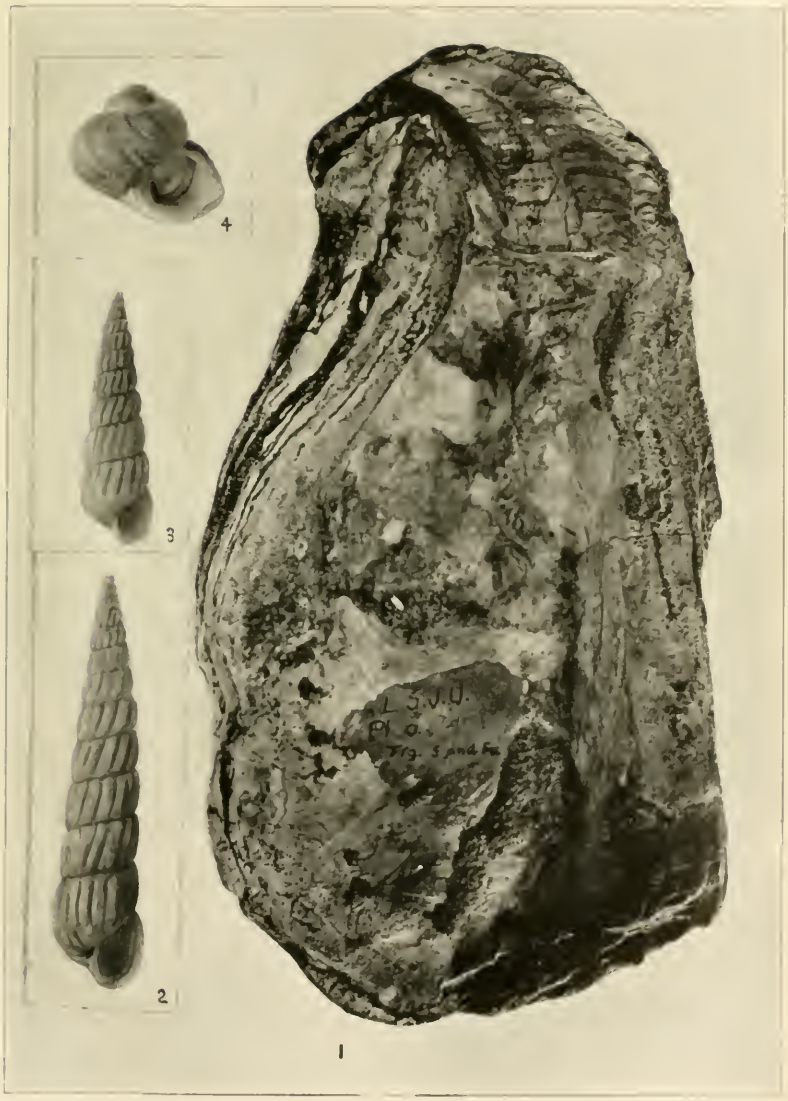
BY CHARLES W. JOHNSON

I regret that I must still question Professor Arthur P. Jacot's determination of *Donax variabilis* from Long Island, N. Y., mentioned in the April Nautilus, and also the record of Messrs. Albert Elmer Wood and Horace Elmer Wood, 2nd, from New Jersey (Nautilus, Vol. 41, p. 10, 1927). The specimen figured from Long Island by Prof. Jacot (Journ. Elisha Mitchell Sci. Soc., Vol. 36, p. 137, pl. 11, fig. 15, 1921) is certainly *D. fossor* and not *D. variabilis*. Specimens before me of *D. fossor* from Ocean City, N. J., are identical with the above mentioned figure. In the same publication figure 14 from Beaufort, N. C., is a true *D. variabilis*. The New Jersey specimens also agree with Say's figure and description—"anterior margin [should read posterior] short and rounded * * * base regularly curved at the middle." Figure 16 in the above mentioned journal is not a typical *fossor* but a form described by Conrad as *protractus* (Journ. Acad. Nat. Sci. Phila., 2 ser., Vol. 1, p. 208, pl. 39, fig. 8, 1849), which Dall con-

1. Avicula gregoryi H. & A. 2. Pecten tolmani H. & A. 3. Mactra beali H. & A. 4. Macoma willcoxi H. & A. 5. Pholadomya harbigani H. & A. 6. Cerithium? teslaensis Hanna. 7. Ataphrus pembertoni H. & A.



1. Panopea smithii H. & A. 2. Sonneratia rogersi H. & A.
3. Pecten clarkensis H. & A. 4. Schloenbachia templetoni H. & A.



1. OSTREA TITAN Con. var. PERRINI H. & A.
2-3. TURBONILLA CAVICOSENSIS Willett. 4. LEPTOTHYRA ENGBERGI Willett

siders only a large senile specimen. As it was described from a number of odd valves taken at St. Joseph's Bay, West Florida, and collected elsewhere, it seems worthy of retention as a variety.

In 1892 Dr. Dall (Nautilus, Vol. 5, p. 125) published a paper—"On the species of Donax of Eastern North America." In a concise table he emphasized the sculpture in determining the species and it is this character that I have always used in separating the two species.

Donax fossor has the posterior end rounded, the sides not angular, and the radiating sculpture is superimposed by a thin layer making the surface of the shell entirely smooth. Through this layer however the radiating lines can be seen with a hand lens. Say describes these as "regular impressed lines not visible to the unassisted eye and obsolete on the posterior [anterior] margin." Shells about half grown have obsolete riblets on the posterior end but not approaching in size those of *D. variabilis* of a corresponding length, which have a sculpture visible to the naked eye. The shell in *D. fossor* is noticeably thinner than in *D. variabilis* of the same size (12 to 15 mm.), therefore the crenulations on the margin are smaller. It is the most common shell on the New Jersey coast. At Anglesea I once saw them washed out of the sand in pools around the stanchions of a wrecked vessel, almost a bushel of living shells being present in each pool. The Messrs. Wood in the paper referred to above—"A quantitative study of the marine mollusks of Cape May County, N. J.", counted 1510 live *Donax* in one square foot. It was the fact that *D. variabilis* has not been found on the New Jersey coast that made me question their determination. To my knowledge *D. variabilis* has not been found north of Cape Hatteras. *D. fossor* has not been found north of Long Island, N. Y., although the sandy shores of Marthas Vineyard and Nantucket seem favorable for its existence.

Donax variabilis has the posterior obliquely truncated and the sides noticeably angular, the riblets with inter-

spaces of about equal width being visible to the naked eye. It reaches a length of from 20 to 25 mm. On the Florida coast it is so plentiful as to be used in making bouillon.

There is another species that frequents the coast from Florida to Texas, which might be confused with the young of *D. fossor* and *variabilis*. This is the *Donax tumida* Phil. (*obesa* d'Orb.). The shell is more inflated, the posterior end shorter and more rounded, the striae superimposed, being visible only with a lens. Length from 10 to 12 mm.

BOSTON MALACOLOGICAL CLUB

The Boston Malacological Club has held its regular meetings during the past season, on the first Tuesday evening of each month, from October to May, inclusive, at the Library of the Boston Society of Natural History. The average attendance at the meetings has been about fifteen—and three resignations have been offset by the acquisition of seven new members—the Club list now numbering forty-three.

The first meeting of the season was devoted to the Pholadidae. The second, in November, to Liguus; the President, Mr. William J. Clench, Curator of Mollusca at the University Museum at Harvard, showing the specimens which he had recently collected in Cuba; among them being several new forms.

In January, the Club listened to Dr. W. J. Crozier, of the Department of Physiology at Harvard, who told of four years of study and collecting in Bermuda, where he specialized on Chitons, Nudibranchs, Onchidiums and Squids. His talk was illustrated by many lantern slides. At the February meeting, Dr. Albert H. Navez, formerly of the University of Brussels, Belgium, and now of the Department of Physiology at Harvard, spoke on Brazilian Forests, where he had spent a year collecting; notably in the region near Rio de Janeiro, and on the borders of the Amazon.

In March, Mr. Charles W. Johnson gave a paper on the Fusidae and Fasciolariidae, illustrated by specimens from the Natural History Society's collection; and at the April meeting, Mr. Clench told of a recent collecting trip to the Everglades of Florida, in search of Liguus, and showed a superb set of these shells, including several new forms.

The May meeting was given over to a study of the Urocoptidae, with specimens from the Society's collection, and enlarged pictures of the shells, thrown on the screen by the radiopticon.

At each meeting through the season, Mr. S. N. F. Sanford, Conchological Recorder of the Club, showed a list gathered from current scientific magazines, of articles which might be of interest to those studying malacology or conchology.

The annual election of officers was held at the May meeting. Mr. Clench being re-elected President, Rev. Oliver P. Emerson Vice-president, Miss Theodora Willard Secretary-Treasurer, and Messrs. J. Henry Blake and Arthur F. Gray members of the Executive Committee. The Annual Field Meeting was held June 1st at Coffin's Beach near Annisquam, under the leadership of Mr. F. N. Balch. An enjoyable time was had and a number of interesting shells obtained.

THEODORA WILLARD, *Secretary.*

CONCHOLOGICAL CLUB OF SOUTHERN CALIFORNIA

As the Conchological Club of Southern California—like a great many others—officially closes its year with the June meeting this seems an excellent time to send in a brief report of our doings.

We now have thirty-two active and fifteen corresponding and honorary members, and for the past year have maintained an average attendance of eleven, the difference being partly due to the fact that several of our members belong to a general nature club which meets the same evening and

in part to the distance which many of the members must come. Two of our members have passed on during this year—C. E. White, repeatedly President of the Club, and owner of one of the best private collections on the Pacific Coast, and Mrs. Ellen Golisch, widow of W. H. Golisch, whose collection is now at the Calif. Inst. of Technology. Both had been members for years and are greatly missed.

We meet the 2nd Tuesday evening of every month—summer included—in the Public Library Building of the City of Los Angeles, the meeting being announced on the Library bulletin board and open to anyone interested, so any reader of the NAUTILUS who chances to be in Los Angeles on our meeting night is hereby specially invited to join the gathering.

Our program consists regularly of two papers—one technical or systematic—and one dealing more with collecting, or habitat notes, both usually illustrated with specimens, and followed or accompanied by general discussion. As none of the Eastern conchological leaders have come our way lately and every conchologist within 65 miles is a member, the Club has had no guest speaker this year. Better luck next time.

The conchological display in the Los Angeles County Museum renders it unnecessary for the Club to maintain a permanent display for public use, but small temporary displays are arranged in local or branch libraries whenever desired, this usually looked after by the nearest member. Talks to small study clubs, high school, science classes, etc., are handled in the same way—the Club serving mostly as a center through which connections can be made. So while this work is done there are no figures on the amount accomplished.

Our June meeting will be held at Long Beach, as Mr. H. N. Lowe, who is on the program for that meeting, invited the Club to come there to hear his talk on the shells he has gathered on his trips. We will have a basket lunch in the Park near by, and the business meeting, election of officers,

etc., afterwards. Some are going down in the afternoon that they may have time to view the shells as he has a fine collection. The secretary is Miss Clementine M. Gay.

(Mrs.) E. P. Chace.

NOTES AND NEWS

A Field Method of Preserving.—The following method has been used for some time by Dr. R. T. Jackson[1] of the Museum of Comparative Zoölogy for killing and preservation of Echinoderms. I have used this method on two collecting trips for mollusks and have had excellent results.

Powdered corrosive sublimate ($HgCl_2$), at a ratio of 2/1000 in water is used directly while in the field. This is approximately 2cc. per quart of water. Ordinary mason jars were found to be the best, though any glass or earthenware container that can be tightly sealed for shipping would work as well. Metal containers cannot be used owing to the corrosive action of the compound. A handy method is to have small vials containing measured amounts of the $HgCl_2$, e.g. 1cc. and 2cc. amounts for pint and quart jars. The jars of mollusks were filled to the top with water, the mercuric chloride added then sealed and shipped. All material so handled has arrived at the museum in excellent condition. The special feature of this method is the elimination in the field of large amounts of alcohol and other preserving material and extra containers, as jars were easily obtained practically everywhere during the trips. An added value is that the shells upon drying are impregnated with small amounts of $HgCl_2$ which acts as a protection against museum pests.

Material collected in salt water can just be washed with freshwater before preserving. If material is to be shipped dried, allow 12-24 hours in the preserving fluid for the smaller species and 36-48 hours for the larger forms.

[1] 1927 Mem. Bos. Soc. Nat. Hist., vol. 8, p. 442.

Specimens can then be dried either in the sun or with artificial heat.—W. J. CLENCH.

Word has been received from Dr. Pilsbry, who is on the yacht *Mary Pinchot*, that he is going to continue on the voyage to the South Seas and will not return until late autumn.

FRESH WATER MOLLUSCA IN BRACKISH WATER.—A note in the last number of the NAUTILUS dealing with the occurrence of fresh water molluscs in the brackish water of Barnegat Bay reminds me of a similar condition in the Chesapeake. About half a mile below the Pennsylvania Railroad viaduct over the Gunpowder estuary the water contains 3663 parts per million of dissolved substances at high tide. Of these 1947 parts were chlorides, approximately 50% of the salinity of the ocean. This is sufficiently saline for the occurrence of barnacles on the rocks, and the large edible blue crab occurs, though not abundantly. Yet the only molluscs are *Physa heterostropha*, *Goniobasis virginica*, and *Congeria leucopheata*. Where the salinity is only 30% the crab no longer occurs, but the barnacles and the same species of molluscs occur in company with *Amnicola limosa* and *Planorbis antrosus*. In addition to this fauna I collected some planarian worms, that were not identified, but I am informed that they are very seldom found in brackish water. *Congeria leucopheata* is almost exclusively a brackish water form, though I found a single specimen in fresh water about three quarters of a mile from tide water, and approximately 20 feet above sea level. —JOSHUA L. BAILEY, JR.

NOTES AND NEWS

SOME LAND AND MARINE SHELLS FROM THE MISSISSIPPI DELTA REGION.—The following list of mollusks is based upon a small collection received from Miss M. L. Hays of Happy Jack, Louisiana. Very few records have been pub-

lished for southern Louisiana—and they are mainly in the vicinity of New Orleans. All of the following localities listed are for Louisiana.

Helicina orbiculata (Say), Happy Jack.

Polygyra espiloca (Bland), Happy Jack.

Polygyra thyroides (Say), Happy Jack.

Euglandina rosea bullata (Gould), Happy Jack.

Succinea grosvenorii Lea, Happy Jack.

Murex fulvescens Sby., on oyster bed, Bastian Bay.

Thais floridana haysae Clench, Grand Bayou. Known locally as the "drill".

Distortrix reticulata Link, Shell Island.

Litorina irrorata Say, Bayou du lac.

Architectonica granulata (Lam.), Shell Island.

Polinices duplicata (Say), Shell Island.

Ostrea virginica Gmel., Bastian Bay; Bayou Chalon. These specimens are quite broad, with a rather wide ring of dark reddish brown a little in from the margin on the inside. Commercial fishing is employed on these beds.

Pinna seminuda Lam., Grand Isle.

Modiolus demissus granosissimus Sby., Grand Bayou.

Mytilus recurvus Raf., Bay sans Bois.

Arca ponderosa Say, Grand Isle.

Arca campechiensis pexata Say, Grand Isle.

Arca incongrua Say, Grand Isle.

Cardium robustum Sol., Shell Island; Grand Isle.

Venus campechiensis Gmel., Shell Island; Breton Island. Exceedingly large specimens. The largest one measured: Length 133, Height 120, Width 81 mm.

Dosinia discus Reeve, Shell Island; Grand Isle.

Donax tumida Phil., Grand Isle.

Tellina alternata Say, Grand Isle.

Macoma constricta Brug., Shell Island.

Gnathodon cuneatus Gray, Shell Island.

Periploma inaequivalvis Schum., Shell Island.

Racta canaliculata Say, Grand Isle.

Barnea costata (Linn.), Grand Isle.

—W. J. Clench.

PUBLICATIONS

THE INHERITANCE OF SINISTRALITY IN LIMNAEA PEREGRA. By A. E. Boycott, F.R.S., C. Diver, S. Hardy, and F. M. Turner. [From Proceedings of the Royal Society, London, vol. 104, p. 153, Jan. 1, 1929.]. (Abstract of Communication received November 12—read December 6, 1928.).

1. The common freshwater mollusc, *Limnaea peregra*, is normally dextral; a sinistral variety, in which the spiral twist of the body and shell is completely reversed, is very rare.

2. Sinistrality behaves as a mendelian recessive character, but the appearance of any change of twist imposed by crossing is delayed by one generation. Thus a sinistral fertilized by a dextral produces (F 1) sinistral young which (F 2) produce dextral broods: these dextrals produce (F 3) dextral and sinistral broods in the proportion of 3 to 1. Similarly a dextral fertilized by a sinistral produces dextrals in F 1 and F 2 and a 3 to 1 mixture of dextral and sinistral broods in F 3.

3. Albinism in this snail is also, as usual, a simple mendelian recessive, and is inherited directly: an albino fertilized by a pigmented produces pigmented young in F 1 and F 2 consists of broods each of which contains pigmenteds and albinos in the proportion of 3 to 1. The characteristic shell shape of an Irish lake form of the species also disappears in F 1 on crossing with a normal specimen.

4. It is suggested that the delay in the inheritance of sinistrality is due to the fact that the twist of the animal and its shell is determined at the second—possibly at the first—division of the egg which takes place soon after the entrance of the spermatozoon. Pigmentation and shell shape on the other hand are not fixed till a later period in development and the spermatozoon would have more time to bring its influence to bear.

5. This simple scheme of inheritance is a good deal interfered with by a general tendency for sinistrals to become dextrals, some phenotypic, some genotypic.

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NOTES FROM THE PINCHOT SOUTH SEA EXPEDITION

BY H. A. PILSBRY

Our first stop in the Galapagos was at Tower Island. Imagine a nearly flat lava field, cracked and fissured, practically without soil, but thickly covered with brush growing out of the cracked lava. There is no fresh water, but the innumerable birds and black iguanas seem to thrive without it. Among the stones under bushes I found Pupillidae *(Gastrocopta)* in some abundance, but no larger snails.

Indefatigable Island, being high, is richer in snails. I soon found the Bulimulid group *Naesiotus*, even in the semi-arid shore zone. We tried to reach the summit from Seymour Bay, but on the second day had to give it up, as we came into a country where the brush was so thick that to go through it was out of the question. We had to bend it down and clamber over. Our canteens were nearly empty, and the humid zone still some miles ahead. We had better luck on Duncan Island, easily reaching the summit (about 2,000 ft. elevation) in a day's trip. We found several Bulimulids, a *Euconulus*-like species, a small flat Zonitid, *Succinea Helicina* and Papillidae. At about half way up I heard a wild yell from Dr. Mathewson, who was in the lead. A moment later the four of us were dancing around a huge black tortoise about 4 feet long. I have wanted to see the giant tortoises of the Galapagos in their native islands ever since I read Darwin's *Voyage of the Beagle*. I fell on his shell and embraced him. With a loud hiss he drew his head

and legs in and dropped to the ground. The pleasure of the meeting seemed to be all on our side. These tortoises, once so abundant, are now rare, and on part of the islands extinct. Our best record was three in one day.

Charles Island, though rocky near the coast, has very good soil and abundant verdure in the interior. We found five species of *Naesiotus*, many Succineas and various small snails. Part of the Bulimulidae could be collected by hundreds from weeds and shrubs. On Hood Island, which has a height of only about 600 ft., there were two fine Naesiotes in a bluff about a mile inland. We did not reach the higher ground, as we were anchored far from it, and travel through the thorny brush is slow.

Chatham Island has a settlement of about 600 persons, mainly Ecuadorian Indians. The Bulimulids are partly columnar forms. Six or seven species were found between the settlement and the shore at Wreck Bay—about five miles. Also Pupillidae and other small forms.

A three-toothed *Naesiotus* was abundant at Academy Bay, on the south coast of Indefatigable Island.

The marine collecting is generally not very good, though there are rich spots. Chitons of the *Radsia* group are common, but live under stones, not out in view as at Panama and Cocos Island. The largest Gastropod is *Fasciolaria princeps*. Dredging from the launch is rather exasperating work, as nearly every haul the dredge is hung up on a rock, but the returns are fairly good. There is a large *Tonna*, but I did not get it alive. The limpets are small and not comon, but Fissurella is abundant.

We will probably visit a few more islands before sailing for the Marquesas, where I hope we will find more coral and a richer marine fauna.

THREE NEW SNAILS FROM THE HILLS OF CALIFORNIA

BY S. STILLMAN BERRY
Redlands, California

MICRARIONTA (EREMARIONTA) MORONGOANA, n. sp.

Diagnosis: Shell helicoid, of moderate size and thickness, depressed-conic; the whorls usually 4½ or 4¾, rapidly enlarging, the last tumid and descending parietally. Aperture large, oval, oblique, the peristome distinctly thickened and everted, especially at the columella. Umbilicus moderate, its diameter contained usually about 9 or 10 times in that of the shell. Embryonic shell studded with numerous strong hyphen-shaped papillae arranged in forward-slanting lines, this ornamentation giving way on subsequent whorls to a more minute and less definite papillation which becomes wholly obsolete before the formation of the body-whorl. Periostracum thin and polished, the coloration generally similar to that of other species of the group and with a conspicuous brown band bordered by lighter areas, but the interior is more or less ochraceous.

Max. diam. 20.1, alt. 11.1, diam. umbilicus 2.5 mm.

Type: Cat. No. 6500 of the author's collection.

Type locality: Gulch on north side of Morongo Pass, 2 miles below the Moreongo Inn, Colorado Desert, California (E P. & E. M. Chace).

Remarks: This interesting and very distinct species shows some affinity with the *indioensis-wolcottiana* group of the genus, but differs in its tumid body-whorl, expanded aperture, and ochraceous interior.

MICRARIONTA (EREMARIONTA) BORREGOENSIS, n. sp.

Diagnosis: Shell helicoid, large for the group and fairly thick, depressed-conic; whorls about 5, convex, with the last moderately descending parietally. Aperture rounded, oblique. Peristome little thickened and but slightly everted except at the umbilicus; the latter wide, a little less than 1/7 the diameter of the shell. Embryonic whorls microscopically heavily papillose, the periostracum otherwise de-

void of sculpturing. Color of shell light brownish fawn, with a conspicuous brown spiral band margined lighter.

Max. diam. 22.0, alt. 11.8, diam. umbilicus 2.5 mm.

Type: Cat. No. 6913 of the author's collection.

Type locality: Palm Canyon, west side of Borrego Valley, San Diego County, California (F. M. Reed, L. M. Klauber, et al).

Remarks: This is an entirely distinct *Eremarionta* unlike any of the forms from the California deserts hitherto described, as well as being one of the largest. It is exceeded in size only by the much more rotund *M. wolcottiana* (Bartsch).

HELMINTHOGLYPTA TUDICULATA KERMENSIS, n. subsp.

Diagnosis: Shell helicoid, large, low rounded-conic, tumid, rather thin, heavily malleated above as in *tudiculata* s. s. and similar in most respects to the typical race as found in the vicinity of San Diego except that the shell is more depressed and is *conspicuously umbilicate*, the umbilicus only a trifle covered by the columellar reflection of the peristome.

Max. diam. 30.4, alt. 19.7, diam. umbilicus 2.7 mm.

Type: Cat. No. 6863 of the author's collection.

Type locality: Under moist logs, Poso Creek, Kern Co., Calif. (L. G. Ingles and M. Smith).

Remarks: This large, conspicuously umbilicate and malleate race of the most widespread southern Californian helicoid appears to be a common and characteristic form in Kern County and is at hand from many localities there. It seems strange that no racial name has ever been attached to it. It will be dealt with more fully, as also the two preceding species, in certain more extended papers now in preparation.

ON THE OCCURRENCE OF HENDERSONIA IN CRAWFORD COUNTY, WISCONSIN

BY J. P. E. MORRISON

It was my good fortune to be able to make a collecting trip to southwestern Wisconsin during the spring of 1928 and again in the fall of the same year. Both trips were made possible through the courtesy of Mr. A. C. Himley, of Madison, who accompanied me.

The region of southwestern Wisconsin includes the so-called Driftless Area, where it is believed that many species may have escaped extinction in this part of the country, and have had centers of dispersal, after the last glacier sheet disappeared. Crawford County, Wis., is very nearly in the center of this non-glaciated area.

A very restricted portion of the country around Soldier's Grove was studied. Soldier's Grove is in the northeast corner of the county. The aspect of the valleys and the uplands is that of typical non-glaciated country, with many abrupt slopes, and with regularly narrow valleys, even those of the smallest streams being very regular from head to mouth. The outliers left by erosion in the larger valleys, such as in the valley of the Kickapoo River, often show a regularly conical shape. The rock strata outcrop in many places, and show a very marked development of talus slopes at the bases of the steeper sides of the ravines. The rocks seen outcropping here are limestone in all cases. On every hand the slabs of limestone form a portion of the forest floor, where there is still forest remaining.

The forests that remain are all second growth, where the land has been cut over, and later allowed to return to brush and trees. Most of the upland forest has been removed, and this portion of the country in the immediate vicinity of Soldier's Grove is almost entirely under cultivation or pasturage. The lowlands are in part under cultivation, but a good portion of them is not used because of the difficulties of overcoming the flooding of the lower flood-plain areas.

Quite by chance, on the first trip, a single specimen of a snail new to us was seen, and then in another spot a whole series of specimens was encountered. At once it was recognized as the rare *Hendersonia occulta rubella* (Green), a species formerly. Accordingly, further search was made for the species, in order to determine the extent of its occurence. The second trip was made to obtain additional specimens and to determine the seasonal activity of the animal.

The list of species found at each station follows. The stations are arranged as a series, from the wettest to the dryest habitats.

Station I. Floodplain of the Kickapoo River, near the mouth of Trout Creek. Snails were found dead in the drift and alive under drift logs and in the finer portions of the drift. The river is rather deep, with high banks, and most of the drift is found a small distance away from the river, where the floodplain is wider. Species:

Polygyra monodon fraterna (Say)
Pyramidula alternata (Say)
Agriolimax campestris (Binn.)
Succinea ovalis Say
Succinea retusa Lea
Succinea avara Say
Zonitoides arboreus (Say)
Gonyodiscus cronkhitei anthonyi Pils.
Pomatiopsis lapidaria (Say)

The preceding species were taken alive.

Stagnicola exilis (Lea)
Helisoma trivolvis (Say)
Planorbula armigera (Say)
Stagnicola caperata (Say)
Fossaria parva (Lea)
Physella gyrina elliptica (Lea
Gyraulus parvus (Say)
Campeloma rufum (Hald.)
Musculium truncatum (Linsley)
Helicodiscus parallelus (Say)

These were found dead in the drift.

Station II. The lower portion of the floodplain of Trout Creek that is subject to overflow. Not very much drift is found here; the soil shows a layer of very fine silt as a result of its flooding. Snails were found under logs and in the scanty leaf mold. Species:

Polygyra monodon fraterna (Say)
Pyramidula alternata (Say)
Gonyodiscus cronkhitei anthonyi Pils.
Helicodiscus parallelus (Say)
Vallonia pulchella (Mull.)
Vitrea hammonis (Strom.)
Agriolimax campestris (Binn.)
Succinea ovalis Say

Station III. That portion of the floodplain of Trout Creek that is above the reach of ordinary high waters. This station includes the very mesophytic slopes of the sides of the creek valley that are rather heavily overgrown with brush and small trees. The snails were found under small logs (not drift logs) and in the leaf mold. Species:

Polygyra hirsuta (Say)
Polygyra monodon fraterna (Say)
Polygyra clausa (Say)
Polygyra profunda (Say)
Vallonia costata (Mull.)
Strobilops affinis Pils.
Gastrocopta contracta (Say)
Cochlicopa lubrica (Mull.)
Zonitoides limatulus (Ward)
Euconulus fulvus (Drap.)
Vitrea indentata (Say)
Pyramidula alternata (Say)
Gonyodiscus cronkhitei anthonyi Pils.
Helicodiscus parallelus (Say)
Agriolimax campestris (Binn.)
Pallifera dorsalis (Binn.) ? Immature
Succinea ovalis Say
Succinea avara Say
Carychium exile (Lea)
Pomatiopsis lapidaria (Say)
Hendersonia occulta rubella (Green)

Station IV. Wooded portions of the ravines that branch off Trout Creek Valley; the exposure of the slopes studied (on the Himley Farm) was mostly to the northeast. The ravine studied in detail is about one mile up from the mouth of Trout Creek, and nearly two miles out of town. Species:

Polygyra profunda (Say)
Polygyra monodon fraterna (Say)
Polygyra thyroides (Say)
Pyramidula alternata (Say)
Helicodiscus parallelus (Say)
Vitrea hammonis (Strom.)
Euconulus fulvus (Drap.)
Strobilops affinis Pils.
Carychium exile (Lea)

Gonyodiscus cronkhitei anthonyi Pils.
Hendersonia occulta rubella (Green)

Station V. Slopes of northern exposure in the valley of the Kickapoo. These were studied on Asper Heims Hill, which is an outlier, just to the west of the town. The slope here is very steep, and heavily wooded, with a good many fallen logs. Snails were collected from the leaf mold and from under the logs, which were mostly in stage three of decay, with the inner, heart-wood still solid. Species:

Polygyra profunda (Say)
Polygyra monodon fraterna (Say)
Pyramidula alternata (Say)
Helicodiscus parallelus (Say)
Zonitoides limatulus (Ward)
Strobilops affinis Pils.
Gastrocopta contracta (Say)
Hendersonia occulta rubella (Green)

Station VI. Smaller ravines branching directly off the valley of the river. These ravines have no permanent streams in them; they are covered with rather open woods and brush. The exposure is to the north. Snails were found under logs, under rocks, and in the rather dry and loose leaf mold. Species:

Pyramidula alternata (Say)
Euconulus fulvus (Drap.)
Vitrea hammonis (Strom.)
Strobilops affinis Pils.
Gastrocopta armifera (Say)
Gastrocopta contracta (Say)
Gastrocopta pentodon (Say)
Cochlicopa lubrica (Mull.)
Carychium exile (Lea.)
Philomycus caroliniensis (Bosc.)

Station VII. Slopes of southern exposure in the valley of the Kickapoo. These also were studied on Asper Heims Hill. This portion of the hill is under pasturage, and represents perhaps the most unfavorable habitat for snails, of all. The ground is bare except for grass and a few small herbs; there are many flat limestone rocks, under which the snails were found. Species:

Gastrocopta armifera (Say)
Pupoides marginatus (Say)
Helicodiscus parallelus (Say)
Zonitoides arboreus (Say)
Vallonia pulchella (Mull.)
Agriolimax campestris (Binn.)
Succinea avara Say

In summary it may be said:

1. That *Hendersonia occulta rubella* (Green) occurs, living, at Soldier's Grove, Crawford Co., Wisconsin.

2. That at this locality it is restricted to the region above the high water mark of the floodplains, and below the upland. Here it is most abundant just above the reach of flood waters, becoming less common as the uplands are approached.

Since nearly all the records of the occurrence of this species as a modern form are from the Driftless Area of southwestern Wisconsin, northeastern Iowa, and southeastern Minnesota and from the Appalachians, these two regions must be considered the regions of survival of the species.

Conversely, it is the author's belief that further search will show the species more or less uniformly distributed over the non-glaciated area mentioned.

For previous records of this species, see Shimek's paper (Proc. Davenport Acad. Sci. 9:173).

The specimens of *Hendersonia* described as having been collected at this locality are in the collection of the writer, with duplicates deposited in the museum of the Acad. of Nat. Sci. of Philadelphia, and in the museum of the University of Wisconsin (UW No. 4776), at Madison.

FACTORS IN THE EVOLUTION OF THE PROSOBRANCHIATE MOLLUSC, THAIS LAPILLUS

DR. H. P. K. AGERSBORG
State of Illinois, Department of Conservation

The aim of this paper is not to set forth the degrees of evolution in the mollusc, *Thais lapillus*, but to call attention to an apparent process of this phenomenon, *viz., variation.* Also, to indicate, at least, some of the environmental factors, probably responsible for the divergence and maintenance of the apparent physical conditions of these animals.

It is a known fact that *variation is.* But the question still remains: *How does variation take place and under what condition does it continue the most extensively?* An extensive, continuous evolution through variation would be enhanced the best under, or by an extensive, continuous variation. Do environmental conditions contribute to this? To answer this question one may point out the kinds of variation this species is undergoing and the general and specific environmental conditions to which it is subjected.

Collecting different species of gasteropod molluscs on the coast of Northern Norway, during the summer of 1920, it was noticed that the species, *Thais lapillus,* showed a great variety of difference in the nature of the shell in color, in the height, the greatest diameter, the least diameter, the spire, the sutures, the operculum, the slant of the apex, and the aperture formation. Some shells are thick and rough with small aperture; some are thick and smooth with a large aperture; some are rough, thick, and large with a long apex; some are thick, and rough with a short apex; other shells are thin and rough or smoooth with a small or large aperture and with a long or short apex; still others are thin with uniform color, others with diversified color, still others are smooth with uniform or diversified color and of variable size.

Now, it should be borne in mind that the coast line of Norway is very famous for its abundantly diversified nature. It is broken up into bays and inlets, fjords and straits, islands, islets and scheries; it is sprinkled with towns, fishing villages, and fishing steads; rivers, rivulets, and brooklets. Each of these provides a special home for the species, collectively they are lending a helping hand to the changing processes going on in the *Thais.* The winds, waves and weathers of the years are also adding their quotas towards changing the living conditions for this organism. The peculiar setting of each place offers a special harbour for various species that may serve as food for hungry young and old of the Thais population.

The thin-shelled individuals of *T. lapillus* occurred invariably in the sheltered places, although some of these also live under semi-exposed situations. Beneath the docks of fishing villages and fishing steads were the most favorable abodes for this variant. The diversified colored ones occurred the most abundantly both in number and in degrees of coloration beneath docks from which seepage of brine and sometimes urine was considerable. The thin-shelled snails occurred also here but were also present in sheltered and semi-sheltered places away from the docks. The most highly corrugated and thin-shelled variety occurred on rocks and piles under the docks of herring salteries, as for example, Indre Kvaröy and Sandnessjöen in Nordre- and Söndre Helgeland, respectively.

Large, thick-shelled individuals with relatively long apex occurred the most commonly in estuaries. The color of this variety tends to blend pretty well with the sub-stratum. The shell is smooth.

Large, rough-shelled individuals with a relatively long apex occurred in sheltered places where food was abundant, *e. g., Balanus*, sheltered from the sun by sea-weeds and protected against the battering waves by pockets and crevices in the rocks. If loosened by a dashing wave a snail would drop into one of these pockets with a short distance to the field of food. The best natural habitat for *Thais* seemed to be in places where the circulation of the sea from the open fjord was pretty constant, bringing in the *Balanus* larvae during the season. But *circulation* and *food* and sea-weed shelter were only conditional; one additional factor might upset completely all these. That is, too precipitous rocks above deep waters (160 meters), had no *Thais*. Snail occurring here, from time to time (the adjacent territory on both sides was richly populated, the water being shallower) evidently would not be able to crawl back if dropped to the depth of 160 meters, more or less.

The rough, thick-shelled snail, with small aperture, occurred high on the rocks in the tension zones in semi-

brackish water, sometimes in small freshwater pools along the edge of high water, remaining out of the sea water apparently most of the time.

The average type occurred everywhere, near or below the low water mark.

In other words, *T. lapillus* has not only a wide range of adjustment capacity to environmental conditions, but this adjustment capacity is reflected in the physical appearance of the species.

That is, those that occur on rocks above salt water in the tension zone between salt- and freshwater, *e. g.*, between dry land and the sea, are thick shelled, rough (corrugated) with small aperture, and of moderate size.

Those that are found in fresh water pools above high water levels are sometimes thin shelled but of medium size.

Those that live on the rocky floor of estuaries (with plenty of food) are smooth shelled, and large, with grayish color.

Those that live under docks of herring salteries, subject to seepage from salty refuse are small, thin-shelled, corrugated, variable in color and plentiful in number.

Those that live on the outside of the docks in more moderate waters resemble the last named, but are larger.

Those that occur in the open straits where an abundance of food occurs are of variable size, shape, thickness, corrugation and color (although the coloration is moderate).

Finally, those that occur everywhere between the medium low-tide and below low-tide level are of all sizes, all forms and colors, but in all respects much more moderate than any of the types occurring in the other described situations.

It seems, therefore, then, that the environment is responsible for something. Does it foster eccentricities present in the germ plasma which by heredity are transmitted from generation to generation but which at times are subjugated sufficiently so as not to appear or to stand out so prominently as at other times?

Individuals of *Thais lapillus* accidentally segregated into

different physical and chemical environmental conditions radiate in different directions. As the species becomes adapted to different environmental conditions the physical variation is definitely manifested.

THE PELECYPODA OF THE COOS BAY REGION, OREGON

H. B. YOCOM AND ELTON R. EDGE
Department of Animal Biology, University of Oregon

Among the many works relating to the molluscs of the western coast of North America relatively few references are made to the molluscan fauna of Oregon. No comprehensive work on this group of animals has been published for this particular portion of the Pacific Coast. Since it has been suggested that this region is an intermediate zone between the better known faunal areas of Puget Sound and San Francisco Bay, it was thought that the accompanying list of bivalve molluscs might prove useful to persons interested in carrying on further taxonomic and ecological investigations.

The region selected for this preliminary report is an area around the entrance to Coos Bay—the mouth of Coos River. This selection was made firstly because of the fact that this region offered within a limited accessible area, a wide range of environmental conditions with a rich littoral fauna and flora; secondly because extensive jetty operations are affecting to some extent the physical features both within the bay and along adjacent beaches. These changes will in time probably bring about adjustments in the plant and animal life.

The following list is a record of the results of careful collecting for the summers of 1926 and 1927. While all of them cannot be found in any one location, most of the species can be found within one day since all the above mentioned habitats are within a radius of three miles from the mouth of the bay.

Family *Mytilidae*

Mytilus californianus Conrad
Mytilus edulis Linn.
Modiolus modiolus Linn.
Botula falcata Gould
Botula californiensis Philippi

Family *Anomiidae*

Pododesmus macroschisma Deshayes

Family *Ostreidae*

Ostrea lurida Carp.

Family *Pectinidae*

Pecten hericius Gould
Hinnites giganteus Gray

Family *Leptonidae*

Kellia laperousei Deshayes
Pseudopythina rugifera Carp.

Family *Tellinidae*

Tellina salmonea Carp.
Tellina bodegensis Hinds
Macoma balthica Linn.
Macoma nasuta Conrad
Macoma inquinata Deshayes
Macoma inquinata arneheimi Dall
Macoma inflatula Dall

Family *Mactridae*

Schizothaerus nuttallii Conrad

Family *Solenidae*

Siliqua patula nuttallii Conrad

Family *Myacidae*

Mya arenaria Linn.
Cryptomya californica Conrad

Family *Saxicavidae*

Saxicava artica Linn.
Saxicava pholadis Linn.

Family *Veneridae*

Saxidomus giganteus Deshayes
Saxidomus giganteus brevis Dall
Paphia staminea Conrad
Paphia staminea orbella Carp.
Paphia staminea ruderata Deshayes
Psephidea brunnea Dall
Marcia subdiaphana Carp.

Family *Petricolidae*

Petricola caritoides Conrad

Family *Pholadidae*

Pholadidea penita Conrad
Pholadidea ovoidea Gould
Pholadidea rostrata Val.
Zirfaea gabbi Tyron

Family *Teredinidae*

Bankia setacea Tyron

Family *Cardiidae*

Cardium corbis Martyn

Family *Lyonsiidae*

Lyonsia saxicola Baird
Mytilimeria nuttallii Conrad

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THE GENUS MEGAUSTENIA

BY T. D. A. COCKERELL

In 1857 Theobald described a genus of large *Helicarion*-like molluscs as *Cryptosoma*, no doubt in allusion to the fact that, while the creature is rather slug-like, the animal can be entirely withdrawn into the shell. The type was the *Vitrina praestans* of Gould, 1843. In NAUTILUS, 1912, p.

70, I renamed the genus *Megaustenia*, the name proposed by Theobald being preoccupied. In the course of time since 1857 a number of species have been added, and the genus has been found to extend from Burma to Southern China. At the present time *Megaustenia* contains the following:

M. austeni (Collinge)
M. birmanicum (Philippi)
M. cochinchinensis (Morlet)
M. fragilis (Moellendorff)
M. imperator (Gould)
var. *imperatrix* (West.)
M. inusitatus (Godwin-Austen)
M. messageri (Bav. & Dautz.)
M. praecellens (Von Martens)
M. praestans (Gould)
var. *khyoungensis* (G.-A.)
M. roudonyi (H. Fischer)
M. siamensis (Haines)
(Syn. *paviei* Morlet)

In the vicinity of Nan, in Northern Siam, I could find very few molluscs in the jungle. *Amphidromus xiengensis* Morelet may occasionally be found, and I was surprised to find *Pupisoma orcula* Benson on leaves of coconuts associated with scale insects, on which it apparently feeds.[1] I heard, however, that not far from Nan was a limestone mountain called Pahtoop, and thither I hastened, fully expecting to get snails. Pahtoop is one of a series of limestone hills, more or less like inverted tea-cups in form, which rise out of the lowlands in an abrupt manner, at intervals all the way from Northern Siam to Kuala Lumpur in the Malay Peninsula. My expectations were verified, Pahtoop swarms with snails of many species, and later I was able to collect snails on the southernmost of these hills, at Kuala Lumpur. Almost immediately on reaching Pahtoop I began to find shells which I recognized as those of *Megaustenia*. Mr. Tomlin finds that they are identical with specimens in the British Museum identified as *Cryptosoma siamense*. There is no reason to doubt this reference, but it must be said that they do not quite agree with the photographic figure given by Paul Ehrmann in Sitz. Nat.

[1] Mr. J. R. LeB. Tomlin, who very kindly identified this and other Siamese shells for me, wrote that within a week of the receipt of my *P. orcula*, he received another species of the genus, *P. japonicum*, from Formosa, also associated with Coccidae.

Ges. Leipzig, 1922, fig. 1 of plate. Our shells are distinctly more depressed, with a broader aperture. A characteristic specimen has max. diam. 28 mm. and diam. of aperture 17 mm. Apparently this is not significant as Ehrmann records a shell from his lot with diam. 29.7 mm. and diam. of aperture 18.8 mm. The color is pale brown, somewhat dull, not very translucent, the interior brilliantly shining. There are weak and irregular but evident spiral lines. I found two color varieties, corresponding in character to varieties of *Cochlicopa lubrica*. One (var. *albescens*, n. var.) has the shell milky white; the other (var. *virescens*, n. var.) has it pale greenish. Later, on Pahmeeung Mountain, I obtained *M. siamensis* alive. It not only retires within the shell, but is found firmly glued to pieces of wood, so as to be well preserved from desiccation. When crawling, the animal is about 50 mm. long, the mantle partly overlapping shell; eye-tentacles about 14 mm. long; body dusky ochreous, the caudal region mottled with grey; sole pale ochreous; mantle dusky; margin of foot ochreous, with suffused grey cross-lines; surface of body densely and coarsely warty; body posteriorly sharply keeled; end of body truncate in lateral view, with a more or less distinct angular or horn-like projection above. Compared with the figure of *M. praestans* in Fauna of British India, *M. siamensis* differs in that the mantle seems to overlap the shell less in front, while the flap on the right side is considerably larger, extending beyond the apex of the shell. In other respects there is little difference in the appearance of the animal. *M. praestans* is a smaller, more compact shell than *M. siamensis*. *Macrochlamys hainesi*, a large zonitoid found alive with *Megaustenia* on Pahmeeung, has a different sort of animal, when crawling about 46 mm. long, rather light bluish-grey, not keeled posteriorly; surface rugose; sole and margin of foot pale grey. But the interesting thing is that the incipient caudal horn of *Megaustenia siamensis* is in *Macrochlamys hainesi* Pfr. produced into a long somewhat curved pointed

structure, like the horn of a sphingid caterpillar, but retractile.

While writing on Oriental Zonitoids, I take the opportunity to mention that the entirely white variety of *Ariophanta laevipes* (Müller) is var. *alba* Ckll., named in Science Gossip, April, 1885, p. 77, fig. 55 (from Calcutta).

THE SNAILS OF ZION NATIONAL PARK[1]

BY A. M. WOODBURY

Fifteen species of snails have to date been collected in Zion National Park, Utah. One of them, the *Oreohelix*, is large enough to readily attract attention and common enough to be seen on most all of the trails of the Park. The balance are smaller, not readily seen and must be hunted for in order to be found. Of the fifteen species, two are fresh water snails with well developed shells. The other thirteen are terrestrial snails, of which, one is a slug.

Of the fresh water species, *Gyraulus* is found in clear water ponds not frequented by floods, while *Petrophysa* lives on the walls of the canyon where the water trickles down over the face of the cliffs from springs or seeps. This species appears to be limited in distribution to the main Zion Canyon and was named *Physa (Petrophysa) zionis* by Pilsbry in 1925 on account of this limited distribution. Molluscan life appears to be absent from the river in the canyon on account of the frequent corrasive floods.

The land snails inhabit principally the moist sheltered wooded spots where dead or decaying vegetation, such as logs and leaves is abundant. Some forms, such as *Gonyodiscus* and *Agriolimax*, appear to be more prevalent where moisture is constantly present and not subject to periodic drought. Other forms, such as *Pupilla*, *Vitrina*, and *Vitrea*,

[1] Contribution from the Zoological Laboratory of the University of Utah.

are abundant in spots that are subject to prolonged drought.

The climatic conditions in Zion Canyon are so modified by the half-mile high precipitous walls that many cool shady nooks may be found separated from the exposed hot dry slopes by but the turn of a point or the round of a bend. This makes for many isolated spots where colonies of snails abound and many other slopes and areas devoid of such life. In these colonies, many associated species may often be found living together under practically the same conditions.

Below the Weeping Rock, underneath the trees alongside a tiny trickle of water, the following species were found living together, the area examined being only a few feet in diameter:

Cochlicopa lubrica (Müller), *Vitrina alaskana* Dall, *Zonitoides arborea* (Say), *Gonyodiscus cronkhitei* (Newcomb).

In the shady nook at the north foot of the saddle between the Great Organ and Angel Landing (Saddle Nook), an even greater variety was found. Under the leaves and vegetation, near the edge of a small rill, and underneath the trees and vines away from the moisture of the stream, the following species were found:

Pupilla syngenes (Pilsbry), *Cochlicopa lubrica* (Müller), *Vitrina alaskana* Dall, *Vitrea indentata* Say, *Zonitoides arborea* (Say), *Gonyodiscus cronkhitei* (Newcomb), *Succinea avara* Say.

Above the Emerald Pool, where the dripping water from the cliffs above keeps the vegetation continuously wet, I found *Succinea avara* Say thriving among the decaying leaves underneath the clumps of grass. Slightly lower down where the vegetation was moist but not wet, I found the following:

Succinea avara Say, *Agriolimax campestris* (Binney), *Vitrina alaskana* Dall, *Zonitoides arborea* (Say), *Gonyodiscus cronkhitei* (Newcomb).

Farther down the slope among the dry leaves of maples and grapevines, I found:

Oreohelix cooperi (Binney), *Cochlicopa lubrica* (Müller).

These are typical sheltered spots of the canyon and many

other similar associations of species may be found. It is noticeable, however, that *Pupilla syngenes* and *dextroversa* were found only in comparatively dry situations under trees and grapevines some distance from water. It is also noticeable that snail life appears to be absent in pure stands of oak or where oak leaves predominate among the decaying vegetation. On the other hand, molluscan life appears to be most abundant in the groves where leaves of maple, ash, box elder, or grapevine are abundant.

In the literature,[1] *Oreohelix haydeni oquirrhensis* is reported as occurring at the Narrows in Zion Canyon. For three summers, I have searched for specimens at the place indicated but have failed to find any. I believe the record to be erroneous.

I am indebted to Dr. H. A. Pilsbry of Philadelphia, who visited the Park in 1925, and to Bryant Walker of Detroit, Michigan, for their kind assistance in the determination of material and to Dr. R. V. Chamberlin of the University of Utah for aid and advice in the preparation of this report.

The following snails have been found in Zion National Park, and specimens of each are now in the Park collection and in the collection of the Zoology Museum of the University of Utah.

VALLONIA GRACILICOSTA Reinh.

This snail is rare and hard to find. It was obtained in only one place, under the dry leaves under cottonwood trees near the Narrows.

OREOHELIX COOPERI (W. G. Binney).

This is the largest and most conspicuous snail of the Park. The shells may be found in practically all of the sheltered nooks and the live animals may usually be found following a rain crawling around among the vegetation.

These snails are evidently preyed on by some small mammal, probably mice or rats. I have found piles of shells that had been bitten through in such a way as to extract the contents.

[1] Vanatta, Naut., XXXIV, 1921, p. 141.

Shells of this snail have been collected at the Narrows, Saddle Nook, Weeping Rock, The Grotto, Emerald Pool, Court of the Patriarchs, Wiley's Retreat and many other places.

PUPOIDES MARGINATUS (Say).

This snail is apparently very rare in the Park. In four seasons of casual collecting, I have found two shells only. At the time of collecting, I did not distinguish them from either Cochlicopa or Pupilla and consequently do not know the definite nook from whence they came.

PUPILLA SYNGENES (Pilsbry).

This is a very small snail and hard to find. I have to date located only one pure colony, at the Saddle Nook between the Angel Landing and the Great Organ, although a few shells of this left handed spiral have been found among colonies of the right handed spiral form *(P. s. dextroversa)*.

I have discovered the feeding grounds of the living snails among the dead leaves under ash trees and grapevines in dry situations away from proximity to water.

PUPILLA SYNGENES DEXTROVERSA Pilsbry and Ferriss.

The habitat of this subspecies is practically the same as that of *P. syngenes*. It is reported that colonies of the two often live together and I have found it so in one or two cases. This form has been collected at the Public Camp and at the Narrows, in both cases under ash trees, one case also having grapevine leaves.

COCHLICOPA LUBRICA (Müller).

This snail is of widespread occurrence in the Park. It is found in most all of the terrestrial snail associations and under a great variety of conditions, from the continually moist situations under the vegetation alongside small streams to those situations subject to prolonged periodic drought among the dead leaves and vegetation under cover of the trees.

I have taken it on the Narrows trail, at Saddle Nook,

Weeping Rock, The Grotto, Emerald Pool Canyon, Wylie Retreat, and the Court of the Patriarchs.

VITRINA ALASKANA Dall.

This snail is also of very widespread occurrence in the Park and is found in nearly all the terrestrial snail associations, ranging from conditions of continual moisture to those of periodic drought, among the dead leaves of such plants as maple, ash, box elder and grapevines.

I have taken it on the West Rim, Saddle Nook, Weeping Rock, The Grotto, Emerald Pool Canyon, Court of the Patriarchs and the Narrows.

GLYPHYALINIA INDENTATA (Say).

This snail is not very common in the Park but may be found in many of the terrestrial snail associations. It has been collected at Saddle Nook, The Grotto, and Emerald Pool Canyon. It undoubtedly occurs in many other of the protected parts of the canyon.

EUCONULUS FULVUS (Müller).

This snail is very rare. I have taken it at only one point, alongside a small trickle of water under moist decaying leaves and other vegetation at the forks of the Lodge-Emerald Pool and the Lodge-Court of the Patriarchs trails.

ZONITOIDES ARBOREA (Say).

This species is of common occurrence among the terrestrial snail associations. It is found in the moist parts of the dead leaves and the decaying vegetation subject to periodic drought, and even in damp logs where it often buries itself in the decaying wood.

It has been collected at Weeping Rock, Saddle Nook, The Grotto, Emerald Pool Canyon and elsewhere.

GONYODISCUS CRONKHITEI (Newcomb).

This deep-brown rough-ribbed snail is of quite widespread occurrence. The live snail is found most frequently in damp decaying logs and under decaying vegetation beside small watercourses where moisture is continually

present, but its shells are often found in protected nooks among the dead leaves in situations subject to periodic drought.

It has been collected at the Narrows, Saddle Nook, Weeping Rock, The Grotto, Emerald Pool Canyon and the Court of the Patriarchs.

SUCCINEA AVARA Say.

This common snail may be found under a great variety of conditions, from moist decaying logs in the sheltered nooks to protected spots on more exposed situations subject to prolonged periodic drought. Outside the Park, I once found a shell under a small bush out in the desert, where it must have been subjected to prolonged dry spells.

I have collected the shells at the Narrows, Saddle Nook, Weeping Rock, The Grotto, Emerald Pool Canyon, the Court of the Patriarchs and elsewhere.

GYRAULUS VERMICULARIS (Gould).

This flat planorboid snail appears to live only in fresh water pools not subject to floods, feeding on the green algae in such pools. I have collected it only in the pool in the Court of the Patriarchs.

PETROPHYSA ZIONIS (Pilsbry).

These fresh-water snails appear to be found only on the walls or steep slopes of Zion Canyon where the water from springs or seeps trickles down over the faces of the cliffs. With an extremely large aperture and abnormally large last whorl of their shells, they seem to have adapted themselves to such conditions. In their natural position on the face of the cliff, they appear as small black hemispherical dots scarcely distinguishable in appearance from certain round black algal forms. They appear to feed on the small algae growing in the trickling water.

AGRIOLIMAX CAMPESTRIS (Binney).

This slug is of common occurrence where conditions are favorable. It appears to feed on decaying vegetation, especially wood, and appears to require perennial moisture.

It is often found in moist decaying logs associated with *Zonitoides arborea* or *Succinea avara*.

In addition to the snails actually found in the Park, there are a few species found in other parts of the Dixie region extending off below the Park, whose range may extend up into Zion Canyon. The following forms, specimens of which are in the Park collection, are thus found in the surrounding region:

PISIDIUM CONCINNULUM Sterki.

Collected near Central, Washington Co., Utah, at a small spring locally known as Cane Spring on the St. George-Enterprise road. It was found near the head of the stream in the clean loose sand in the stream bed.

LYMNAEA OBRUSSA Say.

This fresh water snail looks very similar superficially to *Succinea avara* but may readily be distinguished by its habitat, this form being found in the water, whereas *S. avara* is a land snail. I have collected this *Lymnaea* near St. George, in the clear water streams where green algae abound. It is found in company with *Physella virgata* and appears to feed on the green algae.

PHYSELLA VIRGATA (Gould).

This fresh-water snail is found in most of the clear water streams, springs, and ditches of Dixie which are not subjected to corrasive floods. It is especially abundant in those sluggish streams or ponds where green algae abounds and upon which it appears to feed. It has not yet been taken in the streams of the Park.

I have collected it in the streams at St. George, Washington, Central, Enterprise, Ivins, Beaver Dam Wash, and in the Santa Clara Bench reservoir at Ivins. In the sluggish streams, it appears not to reach its highest development, being on the average only about half the size of those found in the Ivins reservoir.

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THE LAND SHELLS OF KAMCHATKA

BY WALTER J. EYERDAM

During the past summer of 1928 I spent three and one-half months in Kamchatka and upon various occasions made diligent efforts to collect land shells. The results were very meager compared with the rewards I have had in more southerly regions. Although a considerable area of South Kamchatka was covered this time, I did not add any additional species to those found in 1925, around the Gulf of Kronotzki and the mouth of the Kamchatka River, several hundred miles farther north.

The following species were taken mostly in the region around Avacha Bay, Avacha River and the adjacent mountains—Polovina, Korjatskaya and Avachinskaia Sopka.

Vitrea alaskana (Dall), common.
Cochlicopa lubrica (Müll.), common.
Euconulus fulvus (Müll.), not common.
Euconulus fulvus alaskensis Pilsbry, common.

Gonyodiscus cronkhitei (Newcomb), common.
Zoogenites harpa Morse, rare.
Polita hammonis (Strom), rare.
Vertigo modesta (?), rare.

Baron von Rosen of the Riabusinski Botanical Expedition to Kamchatka, 1908-1910, wrote a report on the land and fresh water shells of Southern Kamchatka. Besides the eight above mentioned species he has included three Succinea from the banks of the Kamchatka River—*Succinea putris* (L.), *S. pfeifferi* (Rossm.), *S. arenaria* (Bouch).

Practically all the species mentioned are found in the same habitat. They occur in the rich loam at the bases of large annual plants such as *Spirea Kamchatica* and *Heracleum dulce* and other species of *Umbelliferae.* They are often abundant in hollows where the decayed vegetation mixes readily with the volcanic ash. In the birch forests and fields of tall annual plants, on rocky hillsides and along stream banks are found the only shells that occur. In swamps, I have only found a few dead Succenia. In either wet or dry tundras or on large lava flows, I have never found a shell.

Dr. Ditmars, who traveled and collected for a period of four years in Kamchatka during the early fifties of the previous century, mentions in his admirable work on the volcanoes and biology of that region, that there are no land shells to be found there.

The Swedish Kamchatka Expedition of 1921-1924 did not report on the land shells of the region.

It is not likely that any other species of land shells occur in the tundra regions of the north and west coasts of Kamchatka. A few more may be found along the Kamchatka River or at the extreme southern end of Kamchatka around Cape Lapotka, where may be found a considerable number of Kurile Island and Japanese plants.

EGG-CAPSULES of FASCIOLARIA GIGANTEA

THE EGG-CAPSULES OF FASCIOLARIA GIGANTEA KIENER

BY C. W. JOHNSON

Large clusters of egg-capsules of *Fasciolaria gigantea* are conspicuous objects on the Florida coast. The specimen figured (Plate 4) is in the collection of the Boston Society of Natural History and was collected at Key West, Florida. It was referred to in THE NAUTILUS (Vol. 33, p. 46, 1919). This bunch is nine inches in length and contains approximately 400 capsules, attached to a broad band, which has no doubt contracted considerably in drying. Each capsule is about 40 mm. in length and attached to the band by a short pedicel; the capsule is wedge shaped, the angles slightly winged and the sides with five or six irregular ridges. Three of the capsules contained respectively 66, 70 and 76 embryonic shells. If the entire number should average 70 per capsule, the cluster would produce upward of 30,000 shells. The death rate however is enormous and it is doubtful if one in 5,000 ever reaches maturity. I am still looking for a shell of this species two feet in length as recorded by the older authors.

RARE MOLLUSKS FROM NEW JERSEY

BY HORACE G. RICHARDS
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During the past two years the writer has been engaged in making a survey of the marine invertebrate fauna of the coast of New Jersey. A complete report of this survey will be published elsewhere in the near future. However since Mr. C. W. Johnson (1929) inquires concerning certain marine pelecypods that are apparently becoming extinct in southern New England, it may be interesting to mention a few records from New Jersey which concern some of the pelecypods mentioned by Mr. Johnson, and to add a few

notes on other mollusks that have hitherto been considered as unknown or rare in New Jersey.

Pholas (Barnea) costata L. popularly known as "Angel wings" is a mollusk which burrows deep into clay or mud. Mr. Johnson says that to his knowledge living specimens have not been taken in southern New England since 1845. Various writers have recorded the shell from New Jersey beaches, but no one in recent years has observed the living animal.

On July 22, 1929, I had the unexpected pleasure of finding a large bed of this mollusk on the shore of Delaware Bay near Green Creek. They were found in shallow water at low tide with their siphons just slightly elevated above the mud. Upon trying to capture them, they burrowed very rapidly some two feet or more into the mud.

Dr. Thurlow C. Nelson collected some individuals at Pierces Point on Delaware Bay, and a Cape May fisherman reported a bed of "queer bivalves" about two feet deep in the mud on the north side of Cape May Harbor. He ate the animal and sent me the shell which proved to be *P. costata*. I have also dredged this species at the entrance of Cape May Harbor in about 20 feet of water.

Tagellus gibbus (Spengler) and *T. divisus* (Spengler) also burrow deep in the mud and are seldom seen alive. However both species have been taken alive in the muddy bottom of Cape May Harbor. The shell of *T. gibbus* is very common on the beaches of New Jersey, and at Cape Charles, Virginia, shells with the epidermis intact are frequently found, suggesting that perhaps the species is more common toward the south.

The migration of *Littorina litorea* (L.) southward on the Atlantic coast has been observed for many years. It was first reported in America in Nova Scotia by Willis (1863), where it had probably been introduced from Europe. Since that time it has been gradually migrating southward, and is now very common at Cold Spring Harbor, Long Island, and shells in the Academy of Natural Sciences of Phila-

delphia and the United States National Museum, Washington, indicate its presence as far south as Atlantic City, N. J. *L. litorea* is a rock-inhabiting form, and therefore its presence would not be expected on the sandy beaches of New Jersey; however when rock jetties are built this form frequently appears. It has been taken from the rock jetty at Longport, N. J. (Acad. Nat. Sci.), and I collected several living individuals from the Rock Pile at Cape May, N. J., on May 20, 1928. I think that this is the farthest south that this species has ever been recorded. Wood and Wood (1927) say that *L. litorea* clings to grass in the salt marshes of Two Mile Beach, N. J. Since this species is always found associated with rocks and not in the locations mentioned by the Messrs. Wood, they undoubtedly refer to *L. irrorata* (Say) which is common in the marshes of Cape May County.

Littorina rudis (Donovan) and *L. palliata* (Say) have also been taken as far south as Cape May, N. J.

Alectrion vibex (Say) has not been seen alive in New Jersey by the writer, although fresh shells are frequently found on the beach. The absence of this species is interesting since some of Say's original specimens were from Great Egg Harbor, N. J., and Verrill (1873) had found it among Eel Grass at the same locality.

The species is common farther south, and was observed in considerable numbers at Cape Charles, Virginia, on June 16, 1929.

Numerous other mollusks, new or rare for the state, will be discussed in the complete report.

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THE TERRESTRIAL MOLLUSCA OF TURKEY RUN STATE PARK, INDIANA

BY ALVIN R. CAHN AND JACK T. KEMP
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Turkey Run State Park, one of the most attractive spots in Indiana, is an area covering some 460 acres of land. The terrain consists of gently rolling hills, covered with a good stand of white oak, sugar maple, tulip and elm. It is transected by Sugar Creek and its small tributaries, which have cut deep ravines through the sandstone bluffs, and the borders of this gloriously rough area are covered with hemlock. The "bottoms" support gigantic sycamores, walnuts and elms. The ground is well covered with rich humus, and a wealth of moss holds the moisture and makes the area particularly ideal for terrestrial mollusks. That the region is rich in such forms is shown by the fact that forty-four species have thus far been collected. As the park is much used by classes from great mid-western universities, and as mollusks are so much in evidence, it has been found advisable to publish herewith a list of the species of terrestrial forms as an aid and guide to such classes. Many hundreds of specimens have been collected by the writers during the past three years, and all material has been checked and identified by Prof. F. C. Baker of the Natural History Museum of the University of Illinois. To Prof. Baker the writers express their keen appreciation and thanks.

A list of forty-six species of terrestrial mollusks follows:

Polygyra tridentata (Say). Very abundant; living forms common under logs.

Polygyra inflecta (Say). Abundant on exposed slopes.

Polygyra profunda (Say). Decidedly uncommon; under logs usually.

Polygyra albolabris (Say). Not common, but fine large specimens have been collected on the hill sides.

Polygyra zaleta (Binney). Extremely abundant throughout the rough territory.

Polygyra multilineata (Say). Uncommon; four specimens collected.
Polygyra palliata (Say). Not uncommon under logs.
Polygyra elevata (Say). Very abundant; dead shells numerous.
Polygyra pennsylvanica (Green). Very rare; three specimens only.
Polygyra thyroides (Say). Very abundant on exposed slopes.
Polygyra clausa (Say). Very rare; two specimens only.
Polygyra mitchelliana (Lea). Very rare; four specimens only.
Polygyra hirsuta (Say). Rare; five specimens under one log.
Polygyra fraterna (Say). Common under logs and wet rocks.
Polygyra monodon (Rackett). Common on exposed slopes.
Polygyra fraudulenta (Pilsbry). Fairly common; often associated with *P. tridentata.*
Polygyra appressa (Say). Uncommon; under bark of rotten logs.
Polygyra stenotrema (Ferussac). Very abundant throughout the rough country.
Circinaria concava (Say). Very abundant everywhere.
Omphalina fuliginosa (Griffith). Extremely abundant on slopes.
Retinella hammonis (Ström). Not uncommon; under bark and in rotten logs.
Glyphyalina indentata (Say). Five specimens from windrow.
Paravitrea multidentata (Binney). A single specimen from windrow.
Zonitoides arboreus (Say). Abundant locally under rotten logs.
Zonitoides limatulus Ward. One specimen from rotten wood.
Pseudovitrea minuscula (Binney). Uncommon; from windrows and under rotten logs.
Gastrodonta ligera (Say). Not uncommon under logs.

Anguispira alternata (Say). Extremely abundant everywhere.

Anguispira solitaria (Say). Common; reach very large size.

Goniodiscus perspectiva (Say). Fairly common throughout the area.

Goniodiscus anthonyi Pilsbry. Rare; only three specimens found.

Helicodiscus parallelus (Say). Uncommon; six specimens under logs.

Succinea avara Say. Rare and local; found only in the few small marshy areas.

Strobilops labyrinthica (Say). A single specimen found thus far.

Strobilops affinis Pilsbry. Only two specimens found.

Pupoides marginatus (Say). Common locally in grass; often found at the base of a tree. Also in windrows and drift.

Gastrocopta armifera (Say). Common locally; often in windrows.

Gastrocopta contracta (Say). Very common; most easily collected in windrows and drift.

Gastrocopta pentodon (Say). A single specimen on hand.

Vertigo ovata Say. A single specimen from a windrow.

Vallonia pulchella Müller. Not uncommon under logs.

Carychium exiguum (Say). Two specimens from windrows.

Pomatiopsis cincinnatiensis Lea. Rare; two specimens from windrow.

Philomycus carolinensis (Bosc). The common slug. Abundant at night crawling over the sandstone cliffs.

Agriolimax agrestis (Linn.). The small slug found under bark and under logs.

Limax maximus (Linn.). A single specimen found in the basement of the hotel.

CONCERNING A POLICY

WILLIAM J. CLENCH

In 1922, Ortmann and Walker[1] published a paper dealing with several changes in the nomenclature of some North American Unionidae. The expressed opinion given in this paper was really that of three men, Dr. H. A. Pilsbry included.

Ortmann and Walker (op. cit. p. 3), agreed that with any species over which they had a difference of opinion as to its nomenclatural standing, the decision of Pilsbry relative to that species would be accepted as final.

Since the above was published there has been an attempt to bring back again the use of some of the discarded names of Rafinesque. The question now raised is—what will be the eventual status of Unionid nomenclature if no agreement of names can ever be reached? These men took a fair stand in the matter, selecting the first name that could be definitely associated with a given species—showing no favoritism in the preference for any particular author. Priority ruled in all cases where more than one description pertained to the same species. Abiding by their decisions, we automatically "fix" some of these troublesome forms and the names employed come to have a definite meaning.

It seems as though the work of these authors can be taken as final, their decisional names accepted as solving certain taxonomic problems and instituting a policy which if accepted will clear a portion of the Unionid field which is still befogged with a superfluity of names. We, in the field of taxonomy, sometimes take the stand that systematic zoölogy is the end and not the means and that all other phases of biologic study as subservient to it. Developments due to increased knowledge and new discoveries are naturally going to affect classification, but progress in this line is certainly going to remain dormant as long as no settlement is ever reached concerning the validity of a name.

[1] Ortman, A. E., and B. Walker, 1922. Uni. of Mich., Mus. of Zool., Occ. pap., no. 112.

The material increase of interest and workers in experimental zoölogy, genetics and ecology is making a greater demand upon the taxonomist for the exact names of the animals used in the various lines of work. Fluctuating names are not adding to the value of this work or to ease in obtaining bibliographic references.

A policy of acceptance, when based upon the work of recognized authorities, will go a long way towards smoothing out some of these difficulties.

NOTES AND NEWS

MRS. MAXWELL'S CENTENNIAL COLLECTION OF SHELLS.—I have just discovered Ernest Ingersoll's paper on "New shells from Colorado" (American Naturalist, X, 745-747, 1876), listing the species of non-marine shells in the Mrs. M. A. Maxwell Colorado collection at the Centennial Exposition in Philadelphia. This was the collection that attracted so much attention at Philadelphia, because it was one of the earliest (if not the earliest) attempts on a large scale at habitat group work in America. However, it included some unlabelled invertebrate material from other states. Unfortunately Ingersoll assumed that all the material was from Colorado, hence the record of such species as *Goniobasis pulchella* and *G. livescens*. *Physa heterostropha* and some others may, however, have been only incorrect identifications of real Colorado shells. *Patula cooperi*, "said to be abundant about Boulder", is doubtless *Oreohelix strigosa depressa* (Ckll.), which is the common form in that vicinity. I call attention to this paper only that others who may happen to see it may not be misled by it. *Goniobasis* has not been found in the Rocky Mountain states south of Montana.—JUNIUS HENDERSON.

IN A LETTER FROM DR. PILSBRY dated Ancon, July 20th, he says: "We returned to Balboa for fuel oil, etc., before proceeding to the Marquesas. I have collected enough to keep

me busy the rest of my life—but hope to get a lot more in Polynesia. We sail this afternoon. I expect to be back about November 1st."

MARTYN'S UNIVERSAL CONCHOLOGIST.—The interesting remarks on this "famous book of paintings", by Mr. R. Winckworth[1] seem pertinent. Aside from the question of its not being strictly binomial, the apparent method of its publication has always to my mind made the work questionable. There are some eight or nine sets in the United States each one differing slightly from the others, several of which have been described by various writers.[2]

Many of the sets seem to have been prepared as the author had received orders for them, which probably accounts for the various discrepancies. This irregularity of some sets is shown by Mr. Bryant Walker, who says:— "Everything in the make-up of this copy seems to indicate that it must have been one of the latest copies issued and was made up of such plates as were then on hand. The entire omission of plate 156 would seem to show that there were no copies left of that plate. The numeration, part written, part engraved and some both written and engraved; the lack of uniformity in the matter of the neatlines, and the addition of twelve plates not included in the original work all point in the same direction."

In regard to the nomenclatorial standing of this work Mr. Winckworth has defined this so clearly that I take the liberty of quoting the following:

"To me the explanation of the discrepancies from binomialism is that the Latin names are translations of vernacular names. Usually, though not quite consistently,

[1] Proc. Mal. Soc., London, vol. 18, p. 228, 1929.

[2] W. H. Dall, Proc. U. S. Nat. Mus., vol. 29, p. 415, 1905, and vol. 33, p. 185, 1907, the latter being based on a four volume set in the library of the late John B. Henderson, Jr., with a note on a set in the Australian Museum by the late Charles Hedley. S. S. Berry, NAUTILUS, vol. 22, p. 72, 1908. Geo. H. Clapp, NAUTILUS, vol. 27, p. 107, 1914. C. W. Johnson, NAUTILUS, vol. 30, p. 130, 1916. Bryant Walker, NAUTILUS, vol. 32, p. 28, 1918.

where the 'species' name is a noun, it stands alone, e. g. *Aratrum, Aplustre:* where it is an adjective it is attached to a 'genus' name, e. g. *Buccinum prismaticum.* In some cases the genus has to be supplied by guesswork, e. g. in 1 Dall assumes *Alata* is the Latin genus drifted into the wrong column; in 39 it is easy to supply *Voluta* from the English, although *Voluta* is nowhere used in this volume; in 56 Dall ingeniously argues that Martyn intended to write *Fusus toreuma,* although neither *Fusus* nor any English word suggesting it occurs anywhere in Martyn. There are also trinomials, which are explained as genus + species + variety. I will not labour these points, but suggest that the numerous small explanations required to read binomial intention into his tables ask for more guesswork than is reasonable; being acquainted with the *Systema Naturae,* he, like Chemnitz, is binomial by accident in most cases. I am forced to the conclusion that one must most reluctantly disregard his beautiful work as far as nomenclature is concerned.

"The fate of the six genera attributed to Martyn by Dall is then: *Alata* becomes a section of *Strombus,* for which *Monodactylus,* H. and A. Adams is available; *Purpura* becomes *Ceratostoma,* Hermannsen (=*Cerostoma,* Conrad, preoccupied), while *Purpura,* Lamarck, 1799, becomes *Thais* Bolten, 1798; *Clava* becomes *Cerithium,* Brug.; *Mitra* dates to Bolten, 1798, instead of Martyn; *Cochlea,* of which Dall says mysteriously, 'heterogeneous, and not accepted by later authors', is no worse off; *Oliva* by a happy chance remains *Oliva,* Cuvier, 1798, which has several months' priority of *Porphyria,* Bolten, 1798."—C. W. JOHNSON.

A NEW NAME FOR A CALIFORNIA SHELL.—*Liotia acuticostata* Cpr., var. *radiata* Dall, (Proc. Biol. Soc. Washington, Vol. 31, 1919, p. 8) is preoccupied by *Liotia radiata* Kiener (Coq. Viv., Monog. Delphinula, 7, t. 4, f. 9). It can be known as *Liotia acuticostata bristolae,* n. n. It is named for Miss Viola Bristol of Point Loma, California.—FRED BAKER.

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SNAIL NOTES FROM THE CALIFORNIA DESERT

BY S. S. BERRY
Redlands, California

After some years of doubt, a paratypic specimen of *Sonorella fisheri* Bartsch from Johnson Canyon, Panamint Mts., Inyo Co., California, lately received from the United States National Museum, shows this species to be almost certainly not a *Sonorella*, nor even a *Micrarionta*, although the matter might easily have been anticipated from what we know of the other snails of the region. No animal has come to hand for dissection, but if, as I am perhaps foolish enough to believe in this case possible, we can safely judge from the shell characters, the species belongs to *Helminthoglypta*, where it finds its closest alliances in the group of recently described species (*mohaveana, graniticola, jaegeri*, and others), from the southern Mohave Desert, and among these particularly with *jaegeri*.

The Ferriss Death Valley Expedition of 1922 obtained snails in some abundance in the Panamint Range closely allied to or identified with this fine species, but they failed to bring anything of the sort to light from neighboring ranges. A considerable area therefore remains to be bridged before the distribution of this group can find continuous expression on our maps. Meanwhile the extension of the range of the supposedly maritime and montane *Helminthoglypta* into the great desert areas of southern California in this fashion is in itself an interesting and

hardly predictable phenomenon. The attempt to work out the details of this distribution is proving a fascinating proceeding, although the enormous area involved, the lack of roads in many key sections, and the arduous nature of the collecting itself make progress of the slowest.

Of the forms of this genus so far described from the desert, the majority appear to be holding their formal characters and definitiveness fairly well as specimens from new localities come in, but an exception must be taken in respect to the probable distinctness from one another of my *H. mohaveana* and *H. riparia*, the one from the east side of the rocky hills across the Mohave River from Victorville, the other from the rocky outcrop on the river bank above Oro Grande. The foundation material of *mohaveana* was admittedly poor, and additional collections made the past winter (S. S. Berry & W. H. Thorpe) from the cliffs where this same range of hills abuts upon the river brought to light living specimens which while evidently close to the original *mohaveana* can not well be separated from *riparia*. Comparing all three series it becomes evident that the characters relied upon to separate these two supposed species fail in the value assigned to them, and that as a consequence *riparia* either subsides as a complete synonym of *mohaveana*[1] or is reduced to the rank of but a weakly defined subspecies thereof having a peculiar distribution, a point which must await the recovery of living material from the type locality of *mohaveana* for final settlement.

The distribution of a number of these Mohavean species is somewhat peculiar in that it is strikingly discontinuous, what appears to be the same species turning up again and again in entirely isolated stations, as though the present great extent of the desert floor and with it the separation of the snail colonies were a relatively recent phenomenon, too recent to permit the principle of isolation to have been afforded time for the complete specific divarication of the

[1] A view which I believe is shared by Mr. George Willett on the basis of his own collections in the region, which I have not seen.

snails concerned. Quite different problems seem to be indicated by what we know of the snail fauna of the Mohave as compared with those of the neighboring Colorado Desert, where the speciation on the other hand often seems curiously linear and to take place without complete isolation.

Without doubt the most distinct species of snail from all the Californian desert region so far brought to light is the peculiar little *Micrarionta aquae-albae* Berry, described from Whitewater Canyon in Riverside County in 1922. While published as a *Micrarionta* it differs from the other species of that genus in so many important shell characters —small size, thin lip, heavy papillation of entire surface, rough brownish periostracum, brownish maculations on animal, and so on, that its recognition at least as typifying a new subgenus seems inevitable. For this purpose the new name *Chamaearionta* is here proposed. There seems a reasonable probability that additional species of the group remain to be discovered, but at present *M. (E.) aquae-albae* stands unique as the only one known.

A NEW SPECIES OF STROPHOCHEILUS FROM BRAZIL

BY WILLIAM J. CLENCH AND ALLAN F. ARCHER

STROPHOCHEILUS (STROPHOCHEILUS) PORPHYROSTOMA, nov. sp. Figs. 1-3.

Shell imperforate, ovate elliptical, moderately solid, flattened dorso-ventrally. Nuclear whorl flattened, brick red, the color grading off imperceptibly into a pompeian red on the next three whorls. This in turn shades off into a pinkish buff towards the base of the shell. From the nuclear whorl to the body whorl there is a grayish subsutural line terminating at the outer lip. The last third of the body whorl is overlaid with a cinnamon periostracum. The surface of the shell is covered with delicate growth lines inter-

sected by fine spiral lines. Certain areas are faintly pitted and occasionally delicately granulose. Whorls 4⅔.

Aperture narrowly ovate, rather rounded at the base, terminating in an acute angle at the top. Color whitish inside. Peristome acajou red, thick, strongly reflected. The callous continuous with the peristome.

Altitude	Greater diam.	Lesser diam.	Ap. length	Ap. width
59.5	30	24	26	11 mm. Holotype

Holotype: M. C. Z. 79108. Mountain near Jacquaral, Sao Paulo, Brazil. G. M. Allen, collector.

Remarks: This new species is close to *S. planidens* Mich. Some specimens of the latter resemble it in being imperforate, and in lacking a tooth on the outer lip. But *S. porphyrostoma* has a darker shell and a much darker peristome. Its surface is rougher and more pitted, and it is more depressed dorso-ventrally. In the latter respect *S. unidentatus* Sowb. resembles it, but even here the flattening is much less pronounced.

A single specimen only of this new species was taken by

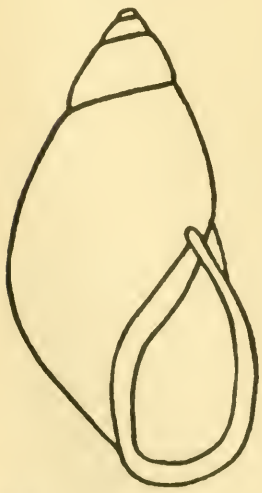

Fig. 1

Fig. 2

Fig. 3

G. M. Allen in Brazil. Together with this he also obtained the following records.

Strophocheilus yporanganus, Pils. & v. Iher. Yporanga, Sao Paulo, Brazil. M. C. Z. 79107.

Oxystyla pulchella prototypus, Pils. Ribeira Creta, Brazil. M. C. Z. 79109.

Thaumastus largillierti, Phil. Yporanga, Sao Paulo, Brazil. M. C. Z. 79110.

FRESH-WATER MOLLUSKS IN BRACKISH WATER AND IN MARINE AND BRACKISH-WATER FORMATIONS

BY JUNIUS HENDERSON

I am much interested in the report (THE NAUTILUS, XLII, 129-130, 1929) of experiments on the resistance of *Physa* and *Lymnaea* to salinity, but the brief report does not throw any light upon two very important problems, namely: How long can these mollusks continue to live in brackish water? Can they successfully breed and continue to thrive under such adverse conditions? If so, then it seems that it should not be difficult to find them actually living under such conditions in some of the many estuaries where slight salinity is produced by mingling of tide water with fresh-water streams. In any event, let us hope the experiments may be continued for a term of years and see what might be possible, whether the same thing is known to occur in nature or not.

In collecting fresh-water mollusks along the Pacific Coast from California to Alaska, including Naiades, Sphaeriidae, *Fluminicola*, *Goniobasis*, *Lymnaea*, *Valvata*, etc., I have often watched for the point at which they disappeared in following streams down to their meeting with tide water and have never found any of them living where I could detect any taste of salt in the water. On some occasions my attention was called to the fact that I was ap-

proaching the ocean, while it was yet far away, by the disappearance of these mollusks, which was apparently due to a slight mingling of tide water, at the head of its flow, with stream water. Possibly the experience of others has been different.

Occasionally a few fossil mollusks supposedly of strictly fresh-water habit are found mingled with a brackish-water or marine fossil fauna. If the fauna is marine, then almost certainly the occurrence of the fresh-water fossils is "accidental", they having perhaps been carried into the ocean by floods from neighboring streams or brought in by some other natural agency. If it is a brackish-water fauna the same explanation is likely correct, though it certainly would depend upon the degree of salinity of the water during deposition and the adaptability of the mollusks to saline conditions. Hence a thorough investigation of this whole problem in all its phases, continuing through several years, is desirable, if it has not yet been accomplished.

It is not uncommon to find a few fresh-water fossil mollusks in the various brackish-water formations of the Rocky Mountain region, but in no case which has come under my own personal observation have the fresh-water and brackish-water species actually occupied the same stratum. Their occurrence has indicated alternating brackish and fresh-water conditions, not a mingling of the two faunas during life.

Dr. Dall, in his great work on the Tertiary Fauna of Florida, lists certain supposedly fresh-water species with marine faunas in such a way as to indicate that they were really marine, which inference he probably did not intend. It is probable that they were accidental intruders brought in by floods or floating drift-wood, or in some such way. Even land snails may easily fall or be washed from sea cliffs into the ocean and become incorporated in strictly marine deposits.

I once found a small but rich deposit of *Physa, Plan-*

orbis and *Lymnaea* apparently in a marine Pleistocene formation in a California sea cliff. Careful investigation proved conclusively that the fresh-water mollusks had lived in a small stream channel cut in the marine formation after it was elevated above the tide, and the channel had afterwards been filled to a level with the general surface of the elevated marine beds. The foregoing are only a few of the many difficulties that beset the paleontologist.

FURTHER RECORDS OF WESTERN CANADIAN MOLLUSCA

ALAN MOZLEY
The Johns Hopkins University

This paper is one of a series dealing with the distribution of the Western Canadian mollusca (see NAUTILUS, XXXIX, pp. 121-128; XL, pp. 54-63; XLII, pp. 13-18). In the course of this work many observations have been made on other phases of the biology of these forms, but the information thus collected is reserved for subsequent publication in more comprehensive form. In all these papers an effort has been made to render the citation of the records as concise as possible, but at the same time to have them sufficiently definite to avoid misunderstanding.

The discovery of living molluscs (*Lymnaea vahlii*) in the waters of Little Quill Lake, Saskatchewan, is of some interest, since this is a highly alkaline lake. An analysis is given below.

ANALYSIS OF WATER FROM LITTLE QUILL LAKE, SASKATCHEWAN[1]

Collected June 12th, 1928. Three miles south of Paskwegin siding.

Made by Dr. Paul Hiebert, University of Manitoba.

Total Solids	9688	parts per million
Alkalinity (as $CaCO_3$)	298.5	parts per million
Chlorides	680.	parts per million
Sulphates	5104.	parts per million
N as NO_3	.02	parts per million
Calcium	96.	parts per million
Magnesium	793.	parts per million
Iron	.05	parts per million

Further investigations on the distribution of the molluscs in the alkaline lakes of Western Canada are at present in progress.

Family HELICIDAE

Vallonia costata (Müller). ONTARIO. Fort Frances. MANITOBA. Grande Pointe. SASKATCHEWAN. Kamsack, near Madge Lake in Duck Mountain, twenty miles north of Kamsack; Quill Lake (station); Wynyard, near Little Quill Lake; Wadena, near Foam Lake; Dafoe; Lanigan; Watson; Dalesford, near Lake Lenore; Kelliher; Touchwood; Humboldt; Saskatoon.

Vallonia sp. ONT. Fort Frances.

Family PUPILLIDAE

Strobilops affinis Pilsbry. ONT. Fort Frances. MAN. Grand Beach.

[1] It should be pointed out that the mulluscs were found actually living in this solution, not merely at the mouths of the fresh water creeks.

Family COCHLIOPIDAE

Cochliopa lubrica (Müller). MAN. Grande Pointe. SASK. Kamsack, near Lake Madge as above; Wadena, near Foam Lake; Wynyard, near Little Quill Lake; Kelliher; Touchwood.

Family ZONITIDAE

Vitrina limpida Gould. ONT. Fort Frances. MAN. Grand Beach. SASK. Quill Lake (station); Watson; Dalesford, near Lake Lenore; Kelliher; Touchwood.

Retinella hammonis (Ström). ONT. Fort Frances; Rainy River. MAN. Grande Pointe; Grand Beach; near Clearwater (Atikamge) Lake, Hudson Bay Railway. SASK. Kamsack, near Madge Lake as above; Wynyard, near Little Quill Lake; Dalesford, near Lake Lenore; Kelliher; Touchwood.

Euconulus chersinus polygyratus (Pilsbry). MAN. Snake Island, Lake Winnipegosis. SASK. Kamsack, near Madge Lake as above; Kelliher; Touchwood; Dalesford, near Lake Lenore; Humboldt; Saskatoon.

Euconulus sp. ONT. Rainy River. SASK. Wynyard, near Little Quill Lake.

Zonitoides arboreus (Say). ONT. Rainy River. SASK. Kamsack, near Madge Lake as above; Kelliher; Touchwood.

Family ENDODONTIDAE

Gonyodiscus cronkhitei anthonyi Pilsbry. ONT. Rainy River. SASK. Kamsack, near Madge Lake as above; Quill Lake (station); Wynyard, near Little Quill Lake; Dafoe; Watson; Dalesford, near Lake Lenore; Kelliher; Touchwood.

Family SUCCINEIDAE

Succinea retusa Lea. MAN. Portage la Prairie. SASK. Margo, Margo Lake; Kuroki, Fishing Lake; Clair Brook, one mile west of Clair station; Dafoe; Wynyard, mouth of Wynyard Creek.

Succinea ovalis Say. ONT. Rainy River. MAN. Grande Pointe; near Clearwater Lake, Hudson Bay Railway. SASK. Kelliher; Touchwood.

Succinea grosvenori Lea. SASK. Dalesford, near Lake Lenore.

Succinea avara Say. MAN. Near Clearwater Lake, Hudson Bay Railway. SASK. Dafoe; Touchwood, between siding and Hudson Bay Lake.

Family LYMNAEIDAE

Lymnaea stagnalis appressa Say. MAN. Birtle, marshes along the bed of Birdtail Creek, and also in many ponds and small lakes north of this point. SASK. Kamsack, pond one half mile west of Kamsack, also in Madge Lake, twenty miles north of the town. Margo, Margo Lake; Kuroki, lake one mile north west of Whitesand Lake; Wadena, Foam Lake; Paskwegin Brook, and in small lake two miles south of Paskwegin siding; Elfros, Birch Creek; Quill Lake (station), Quill Creek; Watson, Ironspring Creek; small lakes between Kelliher, Touchwood, and Hudson Bay Lake; Dalesford, creek flowing into Lake Lenore, two miles south of the hamlet of Dalesford.

Lymnaea megasoma (Say). MAN. Rennie, Rennie River.

Lymnaea caperata Say. ONT. Fort Frances. MAN. Grande Pointe; Birtle, ponds and small lakes north of Birtle station. SASK. Kamsack, pond one half mile west of this town; Elfros; Birch Creek; Kuroki, Van Patten Creek; Clair, Clair Brook, one mile west of Clair station; Quill Lake (station), Quill Creek; Watson, Iron Spring Creek; Lanigan; Kelliher; Touchwood; Dalesford, creeks flowing into Lake Lenore.

Lymnaea sp. (probably *vahlii* "Beck" Moller). MAN. Grande Pointe. SASK. Kamsack, pond in small muskeg one mile west of Madge Lake, Duck Mountain; Kuroki, unnamed lake one mile north west of Whitesand Lake, also in Fishing Lake; and Van Patten Creek; Paskwegin Brook, also in Little Quill Lake three miles south of Paskwegin

siding; Clair, Clair Brook, also in dry drainage ditch south of Clair; Creek between Clair and Quill Lake (station); Quill Lake (station) Quill Creek; Wynyard, large ponds near Little Quill Lake; Watson, Ironspring Creek; Kelliher; Touchwood; Dalesford, creek flowing into Lake Lenore, two miles south of the hamlet of Dalesford.

Family PLANORBIDAE

Planorbis trivolvis Say. ONT. Fort Frances; Rainy River. MAN. Grande Pointe; Onah, Douglas Lake. SASK. Kamsack, pond one half mile west of Kamsack, Madge Lake as above, pond in small muskeg one mile west of Madge Lake; Kuroki, Fishing Lake; Elfros, Birch Creek; Wadena, Foam Lake; Paskwegin, Paskwegin Brook; Clair, Clair Brook, one mile west of Clair station, also in creek between Clair and Quill Lake (station); Quill Lake (station), Quill Creek; Watson, Ironspring Creek; Kelliher; Touchwood; Dalesford, creek flowing into Lake Lenore, two miles south of the hamlet of Dalesford; Yonker, Eyehill Creek; Ingebright.

Planorbis binneyi Tryon. MAN. Indian Bay station, Falcon Bay; Brereton, Lake Brereton.

Planorbis antrosus striatus Baker. SASK. Kamsack, Madge Lake as above.

Planorbis antrosus var. SASK. Kamsack, Madge Lake, as above.

Planorbis campanulatus wisconsinensis Winslow. SASK. Kamsack, several small lakes in the Duck Mountain near Madge Lake, twenty miles north of Kamsack.

FIG. 1. Variation in the form of the aperture in *Planorbis companulatus wisconsinensis* Winslow, from Falcon Bay Indian Bay station, Manitoba. Outline drawings made with the camera lucida.

Planorbis exacuous Say. SASK. Kamsack, small lake one half mile west of the ranger's cabin, Madge Lake; Wadena,

Foam Lake; Kuroki, Van Patten Creek; Kelliher; Touchwood.

Planorbis umbilicatellus Cockerell. MAN. Grande Pointe; Birtle, temporary ponds and intermittent creeks north of Birtle station. SASK. Kelliher; Touchwood.

Planorbis sp. (like *parvus* Say). ONT. Fort Frances. SASK. Kamsack, Madge Lake as above; Margo, unnamed lake north of Whitesand Lake; Kuroki, Fishing Lake; Elfros, Birch Creek; Clair, creek between Clair and Quill Lake (station); Dalesford, creek flowing into Lake Lenore, two miles south of the hamlet of Dalesford; Yonker, Eyehill Creek.

Planorbis sp. (distinct from above). MAN. Lake Winnipegosis.

Segmentina crassilabris Walker. MAN. Grande Pointe.

Segmentina christyi Dall. MAN. Birtle, temporary ponds north of Birtle station. SASK. Kelliher; Touchwood, near Hudson Bay Lake.

Family PHYSIDAE

Physa gyrina Say. ONT. Rainy River, one mile below the Canadian National Railway bridge. MAN. Grande Pointe; Onah, Douglas Lake; ? Clearwater Lake, Hudson Bay Railway. SASK. Margo, unnamed lake one mile northwest of Whitesand Lake; Kuroki, Fishing Lake; Wadena, Foam Lake; Paskwegin, small lake two miles south of Paskwegin siding; Kelliher; Yonker, Eyehill Creek.

Physa ancillaria Say. SASK. Kamsack, Madge Lake as above, also in a small lake a short distance west of Madge Lake.

Aplexa hypnorum Linne. ONT. Rainy River. MAN. Grande Pointe; near Clearwater Lake, Hudson Bay Railway; Birtle, marshes along the bed of Birdtail Creek, also in temporary ponds north of Birtle station. SASK. Margo, unnamed lake one mile northwest of Whitesand Lake; Kuroki, Van Patten Creek, Kuroki Creek; Clair, Clair Creek, one mile west of Clair station, also in creek between Clair and Quill Lake

(station); Watson, Ironspring Creek; Lanigan; Kelliher; Touchwood, near Hudson Bay Lake.

Family VIVIPARIDAE

Campeloma decisum (Say). ONT. Fort Frances, in the Rainy River below this town; Rainy River, in the Rainy River below the Canadian National crossing. MAN. Grand Beach, the Grande Marais.

Family VALVATIDAE

Valvata tricarinata (Say). SASK. Kamsack, Madge Lake as above.

A NEW VARIETY OF ACHATINA PANTHERA FROM MADAGASCAR

BY WILLIAM J. CLENCH AND ALLAN F. ARCHER

ACHATINA PANTHERA BEREVOENSIS, nov. var.

Shell acutely ovate, moderately solid, the ground color of the nuclear whorl whitish shading off into a pinkish buff on the body whorl, and marked throughout by somewhat irregular chocolate streaks. Nearly every streak on the body whorl is washed on the right with deep neutral grey. Surface covered with axial striae. Each whorl covered with fine spiral lines with the exception of the body whorl where they appear only in a region extending about 15 mm. below the suture: Whorls 6½ to 7. Aperture obliquely ovate, bluish grey within, outer lip slightly buff pink, columella and parietal callus white tinged on the outer lip with coral red. Columella sharply truncate, slender, and curved outwards. Base of lip quite flaring, lip itself emarginate.

Length	Diam.	Ap. Length	Ap. Width	
133	71	68	40	M.C.Z. 31078 Cotype.
122	68	63	35	M.C.Z. 31077 Cotype.
122*	68	66	35.5 mm.	M.C.Z. 31079 Cotype.

Cotypes: M.C.Z. 31078. Forest between Mahabo and Berevo, Madagascar. F. R. Wulsin, collector. July, 1915.

M.C.Z. 31077. Berevo, Madagascar. F. R. Wulsin, collector. July 11, 1915.

M.C.Z. 31079. 10 mi. S. of Berevo (elevation 850-900 ft.) Madagascar. F. R. Wulsin, collector. July 12, 1915.

Remarks: This variety differs from *A. panthera, s. s.* as figured by Ferussac, Prodr., p. 49, no. 349; Hist., pl. 126, and as figured by Pilsbry, M. of C. (2), Vol. 17, p. 41, pl. 38, fig. 31, 1904, in the following respects: The shell is smaller, the pinkish buff ground color is spread over the body whorl contrasting with the lighter ground color of the species proper; the streaks are further apart and set in straighter lines, and contrast with those of *A. panthera*, by the less pronounced wash of neutral grey on the right; the axial striae are not so deep, while the spiral lines on the last whorl differ in being confined to a narrow subsutural area, as compared with *A. panthera* where they may be absent, or if present are scattered at irregular distances. The spire is slightly less acute; the aperture narrower as regards its length, and less ovate. The columella is slenderer, and from a side view is more concave than *A. panthera.*

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* The nuclear whorl of this otherwise perfect specimen has been broken and mended, entailing a loss of about 11 mm.

MOLLUSKS BELOW CONOWINGO DAM, MARYLAND

BY WILLIAM B. MARSHALL
U. S. National Museum

On September 10, 1929, the writer, with Dr. C. W. Cooke, U. S. Geological Survey, and Capt. K. B. Squyer, U. S. A., spent several hours collecting mollusks on the east side of the Susquehanna River, for a distance of about half a mile below the Conowingo Dam, Maryland. From the roadway on top of the dam the river southward looks like a paradise for fresh-water mollusks. There are rocks, pools, quiet water and running water; and yet the place yielded only 9 species, two of which were represented by dead specimens only. The pools are almost devoid of vegetable growth, and but little river silt. A couple of pools had a light growth of fine, bright green algae; and in a few pools the bottom was covered by an inch or so of pale yellow, almost impalpable, nearly liquid clay. *Physa* were found in nearly all the pools. In those of bare rock they were creeping about on the rock or on handfuls of leaf mold which were found here and there. They were more abundant in the pools with clay bottoms and here their tracks could be seen running in all directions. *Lymnaea* in smaller numbers were found with the Physas. The pools apparently contain but little life of any kind, other than snails of the genera *Physa* and *Lymnaea*. On the surface of one pool a group of fifteen or twenty of the little black whirligigs (*Gyriscus*) were circling about.

The locality is only about 12 miles above Chesapeake Bay and perhaps four or five above tide-water. It seems likely that later the locality will develop a flora and bottom conditions suitable to many other molluscan species. The dam has changed the river above it into a great lake covering a number of square miles. The quiet condition there now will probably form an ideal residence for many species of mollusks.

The following is a list of the species collected. Although

it contains but nine species, it forms a basis for comparison with future conditions.

Planorbis antrosus Conrad. One living specimen, young. In pool near foot of dam on clay covered bottom.

Physa gyrina Say, *Physa heterostropha* Say. Both were found in numbers, the former the more abundant. In pools near foot of dam; more numerous in those with clay bottom.

Lymnaea modicella Say. Not very abundant. About 25 specimens gathered. In pools near base of dam. Many of them were on the rocky sides of the pool about half inch above the water, in the bright sunlight of mid-day.

On a bar of coarse sand and gravel a third to a half mile below the dam, the following were found:

Goniobasis virginica Gmel. Many living. Most of them are olive color with a brown band on the spire whorls, two bands on the body whorl. Upper whorls nearly smooth; in adults the base is generally prominently spirally ribbed.

Amnicola limosa porata Say. Two, living.

Lampsilis cariosus Say. One, dead but in good condition. Pale orange color with faint radiating greenish stripes on posterior area.

Lampsilis radiatus Gmel. Four, dead.

Elliptio complanatus (Sol.) Dillw. Two living and many dead. The living ones have a brilliant violet-colored nacre. Most dead ones show this color; others show white and a few salmon-color.

From the above it may be seen that *Physa, Elliptio complanatus* and *Goniobasis virginica* compose the great majority of the molluscan denizens. *Lymnaea modicella* has a good foot-hold.

Specimens of all the above are in the U. S. National Museum (Catalogue numbers 381054 to 381062, respectively).

SOME QUANTITATIVE DETERMINATIONS OF GLOCHIDIA

BY AMANDA DICKSON MERRICK

In the course of some experimental studies it became desirable to know the number of glochidia in certain mass units, and to ascertain whether or not the number of glochidia per volume unit was fairly constant for a given species. A review of the literature however, revealed only references to the number of glochidia produced in a season by a female mussel, and some size measurements on individual glochidia of certain species. Accordingly actual counts, weights and measurements of seven species of glochidia have been made. These studies were made at the United States Bureau of Fisheries Biological Station at Fairport, Iowa, and at the University of Missouri.

The marsupia were removed from live, gravid, female mussels and the glochidia freed by cutting each marsupium along the ventral margin, the glochidia being forced out by gentle pressure. The glochidia were then carefully washed in tap water and freed from the remains of the conglutinates by taking up large numbers of glochidia into a pipette and forcing them out again. The cleaned glochidia were next transferred to a weak solution of sodium chloride (0.1%) in which they promptly closed. The closed glochidia were separated, placed in a graduated centrifuge tube, and centrifuged gently until the glochidia were quite closely packed. The salt solution was decanted off and the drops remaining in the tube and on the glochidial mass taken up with filter paper, after which the weighings were made. The glochidia were then preserved for counting in a formalin-alcohol mixture. Linear measurements were made from unpreserved glochidia. In some cases an entire cubic centimeter was counted, but in others only part of the cubic centimeter was counted, and the total computed. A number of glochidia were taken up in a considerable quantity of water and spread over the bottom of a petri

dish, where the counts were made under low power magnifying glass.

All of the species used were of the "long-period" or "winter-breeder" type. In this group the eggs are fertilized during the latter part of summer, usually in August, and the glochidia, which are carried in a fully developed condition in the marsupium throughout the winter, are not discharged until the following summer. It seems probable that there is no increase in size of the glochidia after they become mature from early autumn to winter, and it has been shown (Corwin, 1920) that fish may be infected successfully with glochidia taken from long term breeders in fall, and that these glochidia will undergo development. The counts reported here for *Lampsilis ligamentina, L. luteola* and the *L. anodontoides* var. were made in the months from February to May inclusive, while those for *Lampsilis anodontoides, L. fallaciosa, Symphynota compressa,* and *Strophitus edentulus,* were made during June and July.

Although differences in size of glochidia within the species are noted by Ortmann (1912) and by Howard (1914), the size values obtained in the present studies are in the same range as those given by other workers for closely related species, and the volume values offer additional proof of the enormous number of glochidia produced by a single female in one season.

Corwin, R. S. (1920) ; Trans. Amer. Fisheries Soc., XLIV, pp. 81-84.

Howard, A. D. (1914) ; Appendix IV, Report, U. S. Commissioner of Fisheries, 1913.

Ortmann, E. A. (1912) ; Annals, Car. Mus. VIII, pp. 222-365.

Surber, T. (1912) ; U. S. Bureau of Fisheries Doc. 771, 10 pp.

Physiological Laboratory, University of Missouri.

TABLE NUMBER ONE

Species	Locality	Drainage	Number of glochidia in one cc.	Size in mm.	Weight of one cc.
Lampsilis ligamentina	Lake City, Minn.	Mississippi	101,700	.232 x .265 mm.	.....
Lampsilis luteola	Lake Pepin, Minn.	Mississippi	94,300	.232 x .263 mm.	.....
Lampsilis luteola	Lake Pepin, Minn.	Mississippi	96,900	.232 x .263 mm.	1.0732 gms.
Lampsilis anodontoides	Fairport, Iowa	Mississippi	269,000	.200 x .180 mm.	1.1774 gms.
Lampsilis anodontoides	Fairport, Iowa	Mississippi	243,000	.200 x .180 mm.	1.2525 gms.
Lampsilis anodontoides	Fairport, Iowa	Mississippi	245,000	.200 x .180 mm.	1.2190 gms.
Lampsilis fallaciosa	Fairport, Iowa	Mississippi	185,000	.240 x .180 mm.	1.5604 gms.
Lampsilis fallaciosa	Fairport, Iowa	Mississippi	233,000	.240 x .180 mm.	1.1356 gms.
Lampsilis anodontoides var.	Mercedes, Texas	Rio Grande	77,000	.....	1.0732 gms.
Lampsilis anodontoides var.	Mercedes, Texas	Rio Grande	77,000	.....	1.0988 gms.
Lampsilis anodontoides var.	Mercedes, Texas	Rio Grande	79,000	.....	1.1758 gms.
Lampsilis anodontoides var.	Mercedes, Texas	Rio Grande	100,000	.....	1.1181 gms.
Symphynota compressa	Fairport, Iowa	Mississippi	2,094,400	.090 x .080 mm.	1.1955 gms.
Strophitus edentulus fide Surber, 1912	Fairport, Iowa	Mississippi	537,000	.350 x .285 mm.*	1.0122 gms.

PHYSA AND BULINUS OF MAURITIUS

BY WILLIAM J. CLENCH

A radula examination of *Physa borbonica* Fér. (M.C.Z. 79129) from Mauritius establishes this species as a true *Physa* and not a *Bulinus*. Diagnostic characters of the shells are not certain with the majority of these forms, and all the so-called species of *Physa* from Africa, Asia and the Indo-Pacific region must first be examined anatomically to be absolutely certain of their generic position. Though first described from Reunion (Bourbon), this species is now known also from Mauritius and the Seychelles.

Sganzin also employed the name *borbonica* for this species from the same locality, Bourbon, not being aware that Férussac had described it several years before under the same name. The synonomy of this species is as follows:

Physa borbonica Fér.

1827 *Physa borbonica* Férussac, Bull. Sci. Indus. Vol. 10, p. 408. (Bourbon.)

1838 ———*nana* Potiez et Michaud, Galerie des Mollusques, Paris. Vol. 1, pl. 22, fig. 17-18, p. 225. Mauritius.

1842 ———*borbonica* Sganzin, Mem. Soc. Nat. Hist. Strasbourg. Vol. 3, pt. 2, p. 18. (Bourbon.)

1869 ———*seychellana* E. v. Martens, (in) Reisen in Ost-Afrika, 1857-1865, von C. C. Von der Decken. Vol. 3, pl. 2, fig. 3, p. 60. (Seychelles.)

1880 ———*borbonica* Fér. E. v. Martens, Mollusken Mauritius u. Seychellen, p. 209.

E. v. Martens (Mollusken Mauritius u. Seychellen, 1880, p. 210) places *Bulinus cernicus* (Morelet) in the synonomy of *Isidora*[1] *forskali* (Ehren). Cotypes of Morelet's species (M.C.Z. 79127) are certainly differentiated enough from the typical form as to warrant its retention as a variety. The synonomy would be as follows.

Bulinus forskalii cernicus (Morelet)

1867 *Physa cernica* Morelet, Journ. de Conch. Vol. 15, p. 440. (Mauritius.)

1880 *Isidora forskalii* Ehren. E. v. Martens, Mollusken Mauritius u. Seychellen, p. 210.

SPHAERIUM SCOPOLI; SULCASTRUM, NEW SUBGENUS, AND S. FALLAX, NEW SPECIES

BY V. STERKI

S. sulcatum Lam. holds a peculiar position. It has been grouped with the subgenus *Cyrenastrum* Bgt., i. e. with *solidum* Normand and most of the nearctic Sphaeria. S. Clessin, in his monograph of the "Cycladeen", 1879, placed it under the subgenus *Sphaeriastrum* Bgt. with *S. rivicola* Leach. It is remote from both groups, and represents a subgenus for which the name *Sulcastrum* is proposed. The differences are mainly in the surface sculpture, constant in all of its forms, and wanting in all other Sphaeria. It is densely, microscopically rugulose, dullish all over; the striae, or costulae, are fine, sharp, crowded, regular to subregular; also, the nepionic young are considerably larger. All of this could mean just specific differences; but, with a great amount of material at hand, it appears that *sulcatum* is not only a species very variable, but a group: there are some forms constantly different and distinct, *ergo* species. Two have been described: *S. crassum*, in the NAUTILUS XIV, p. 140, 1901, and *S. lineatum*, ibidem, XXIII, p. 142, 1910; another is described below.

Sphaerium fallax, n. sp., differs from *sulcatum* as follows: The beaks are more anterior, broad; anterior margin r. abrupt to subtruncate, the posterior part markedly

[1] See Pilsbry & Bequaert, 1927. Bull. Am. Mus. Nat. Hist. Vol. 53, p. 133, for a complete statement relative to the status of *Isidora* and *Bulinus*.

longer, attenuate, its dorsal margin passing into the posterior by a more or less marked angle, the posterior end rather angular, well below the median line; the ventral margin slightly curved to nearly straight; the surface is much like that of *sulcatum*, the riblets generally finer and more crowded, somewhat scaly, imparting a slight silky gloss; there are several well marked rest-lines; the hinge is rather slight, with the anterior laminae shorter; the nepionic young are large; dimensions, see below.

Distribution: Region of the Great Lakes, generally more northern, mostly in lakes of northern Michigan and Wisconsin (and probably in Minnesota, etc.).

S. fallax is much like *sulcatum*, and it took years and specimens from many places to justify establishing the species. But when once familiar with it, one can discern them almost at a glance. Be it mentioned that the specimens from one habitat are fairly uniform, as it is with most Sphaeriidae. As a whole, the species is decidedly variable, as to size and shape, extreme forms are quite dissimilar, but connected by intermediate grades. It appears to be in place to cite a few lots in our collection as examples.

The first specimens noted as different and apparently distinct from *sulcatum* were from Mountain Lake, Marquette Co., Mich., collected by Dr. Bryant Walker, in 1898 (No. 1644), and subsequent years; 13-15 mm. long, with the beaks very little prominent.

No. 12514[1]: Ontonagon River, west branch, Gogebic Co., Mich., collected by Joe E. Morrison, in 1929; average large, 19:14:12.5 mm. with the beaks prominent; one was 22 mm. long.

11786: Schlatter's Lake, Keweenaw Co., Mich., received from Dr. Walker, in 1928, small, short, but well formed, 13-14 mm. long.

10933: Whitefish Point, Chippewa Co., Mich., collected

[1] The numbers cited are of the special collection of Sphaeriidae, in the Carnegie Museum.

by Wm. J. Clench, in 1915, per Museum of Zoology, Univ. of Michigan; markedly elongate, about 18 mm. long.

12502: Palmer Lake, Vilas Co., Wis., collected by Joe E. Morrison, in 1929; 16 mm. long.

11602: Chautauqua Lake, N. Y., collected by Dr. F. C. Baker, in 1927, rather short form, 15 mm. long; a rather southern station.

Even as restricted, *S. sulcatum* is still very "variable". E. g., there is a form: very large, 20-23 mm. long, of well rounded outlines, strongly and evenly inflated: this is probably what T. Prime had named *giganteum*. Specimens are in the M. C. Z. collection, and probably in others, from the Hudson River, the Holston River, from Hull, Quebec; Nepean, Ont. Another extreme form, *planatum* St., small, e. g., 13:9.5:6.5 mm., slightly inflated, with the peripheral parts of the valves flat, shell and hinge very slight, color light grayish: from northern Indiana, Michigan, etc., the two, side by side, would be taken for distinct species. And there is one, apparently a regional subspecies, which had been named in manuscripts for many years *dakotense:* of medium size, r. rounded-elliptical, beaks rather median and little prominent; color, dark reddish brown; from Wisconsin and Minnesota to Dakota. There are a few others, more different, with possible claims for specific rank, each represented by several entries, waiting for additional evidence as to their standing.

NEW AND PROBLEMATIC WEST AMERICAN LAND-SNAILS

BY H. BURRINGTON BAKER

This paper is mainly founded on land-snails which were collected during a trip to the Pacific States in the summer of 1929. Because of its anatomy, *Macrocyclis hemphilli* W. G. B. from Washington and Oregon is removed from *Haplotrema* (Haplotrematidae) and made the monotype

of a new genus, *Megomphix*, and a new subfamily, Megomphicinae, in the Zonitidae. On the basis of preliminary dissections, the genus *Pristiloma* is considered a close relative of the European *Vitrea* (Zonitidae); *Ogaridiscus* is made a section of *Pristiloma;* and *P. nicholsoni*, which is a new species from California, *Vitrea johnsoni* Dall (=*Pristiloma taylori* Pils.) from Washington, Oregon and Vancouver I., *Hyalina subrupicola* Dall (Utah), *Vitrea subrupicola spelaea* Dall (Cal.), *Tonites wascoensis* Hemphill (Ore.; also Idaho and Montana?) and *Helix chersinella* Dall (Cal. and Ore.) are added to the genus. *P. arcticum* is reported from subalpine slopes of Mt. Ranier, Wash. A new species of Endodontidae, *Radiodiscus abietum*, is described from Idaho and, because of its aberrant anatomical structure, is made the monotype of a new subgenus, *Radiodomus*. Types are in the Academy of Natural Sciences of Philadelphia.

MEGOMPHIX HEMPHILLI (W. G. Binney), new genus.

Macrocyclis hemphilli W. G. B. (1879, Ann. N. Y. Acad. Sci. 1: 356, pl. 15, fig. M), Olympia, Wash.

Last July, Mr. Allyn Smith of Berkeley, Calif., called to my attention two shells of this species from Riverdale, Ore., which he thought resembled the Zonitidae more than the Haplotrematidae. After several days' search at this place, I found a few living specimens on Aug. 4 and 5, 1929 (No. 149980, in Acad. Nat. Sci., Philadelphia).

Riverdale is a suburb of Portland, on the left bank of the Williamette River near the southern boundary of Multnomah County. The estivating individuals of *M. hemphilli* burrow a few inches into the loose loam under fallen logs on quite steep hillsides, which are dominated by *Pseudotsuga-Tsuga* forest. They usually live under those trunks which are supported off the ground by other debris, which insures the snails plenty of air and comparative freedom from excessive accumulations of decaying humus.

Animal: practically without pigmentation. Foot: aulacopod, medium in size and rather elongate; broadest near

posterior end; pedal grooves double, prominent and with broad interstitial gyrus; sole tripartite to near posterior end, with middle zone about half as wide as either lateral one; locomotion not observed because animals were very sluggish. Tail: wide and dorsoventrally flattened; tip broadly rounded and very slightly emarginate; gland orifice quite large and diamond-shaped; peripodial angle broad, low and emarginate. Mantle collar (pl. , fig. 4).: complete, relatively broad and swollen in palatal region but narrow in columellar; right pneumostomatic neck-lappet large; left one small and claw-shaped; accessory left lappet widely separated and vestigial. Lung (fig. 4) : about 3 times as long as its base or about 4 times length of kidney; principal pulmonary vein large but abruptly divided into a fan of tributaries before it reaches pneumostome; other branches stronger on columellar than on hindgut side; minor venation indistinct. Pericardium: unusually large, with over half its length outside of lung. Kidney: slightly longer than its base and about length of pericardium; thick and with almost half its bulk posterior to lung wall; ureter complete; external ureteric opening under a flap alongside of anus, which empties into a groove to right of inner end of pneumostome.

Ovotestis (fig. 3) : eight groups of irregularly clavate alveoli, imbedded in lower half of liver; duct long, swollen except at ends; convoluted region short; talon exceptionally long, slender fusiform; carrefour imbedded. Albumen gland: brownish cream-colored, firm and shining. Uterus: long and quite slender, closely sacculate. Free oviduct: light cream-colored, of medium length, with heavy walls; joined near its base by a large, cream-colored, ellipsoid caecum, which has a spacious lumen and thick walls (A), that are longitudinally plicate internally. Spermatheca: sac obovate, imbedded near base of albumen gland; duct of long type, columellar in position but passing to right of oviducal caecum; slightly expanded at base. Vagina: whitish, exceptionally long; almost completely encircled near its

upper end by a heavy muscular collar (without lumen) that is white and shining; no distinct glandular development. Prostate: of long type. Vas deferens: swollen along free oviduct; slender where it is forced into penioviducal angle by right eye-retractor; juxtaposed along entire length of penis. Epiphallus (B, C): slightly enlarged, with quite thin wall, which develops into a pilaster along side opposite penis and into a vague corona of low, knobby thickenings near termination; opening by a simple pore on one side of penial apex. Penis: long but quite slender, thickest near apical end; lumen large; walls with numerous, beaded, longitudinal plicae, two of which form heavier pilasters in apical fifth and partially separate a narrow compartment that receives opening of vas deferens. Penial retractor: insertion on penial apex; origin high on diaphram. Cloaca: very short; external opening just behind and slightly below base of right ommatophore.

Mantle retractor: exceptionally heavy. Columellar muscle gives off: (1) buccal retractor which is almost free, (2, 3) heavy, right and left free retractors almost at origin and continues as (4) broad but thin tail fan. Buccal: divided near posterior end of buccal mass into bipartite ventral fan and two, tripartite lateral ones. Left free: divides a short distance below origin into subequal lateral and tentacular retractors; tentacular subdivides near posterior end of buccal mass into small ocular and large inferior retractor, both of which send darkly pigmented anastomoses to base of ommatophore. Right free: similar to left but with all subdivisions anterior to posterior end of buccal mass and with pedal fan much heavier, although not closely associated with uterus; ocular retractor and basal anastomoses passing through penioviducal angle.

Buccal mass: fairly small, ellipsoid. Salivary glands: about 2½ times as long as buccal mass and quite slender (smaller than in carnivorous pulmonates); almost bilaterally symmetric; anterior ends above buccal mass and oesophagus; posterior ends enveloping oesophagus; ducts

arising laterally, near middle of each gland. Jaw (fig. 2): irregularly crescentic; heavy and brownish but quite narrow; weakly and closely rib-striate (i. e., showing vestiges of primitive plaits); growth-lines sharp. Radular formula (fig. 1): 6-12-9-1-27. Transverse rows: 113 counted; almost horizontal in lateral fields, anterolaterally oblique in marginal and again horizontal in outer marginal region. Central: slightly asymmetric, broad and heavy, a little larger than first lateral; tricuspid with broad mesocone. Laterals (1-9): heavy and broad; inner ones almost tricuspid (entoconal plate weakly notched); outer ones intergrading with marginals. Marginals (10-21): much narrower although scarcely longer than laterals; bases much shorter; bicuspid with lanceolate mesocone and small, raised ectocone. Outer marginals (22-27): much shorter than inner; bicuspid or sporadicly with double ectocones; outermost vestigial.

The well-marked pedal grooves of this species place it with certainty in the Aulacopoda. The caecoid diverticulum of its free oviduct is a very peculiar feature. The spacious lumen and internally plicate walls as well as the position of this organ are very different from the structural peculiarities of a Zonitid dart-sac or pugio. Both this oviducal caecum and the reflected epiphallus are somewhat similar to the conditions in the holopod *Strophocheilus oblongus* (Acavidae; cf. H. B. B.: 1926, Oc. P. Mus. Zool. Univ. Mich. No. 167: p. 22, pl. 15).

I cannot believe that W. G. Binney ever saw the radula of this species, as it has no resemblance to that in the Haplotrematidae. Except for the slight elongation of the inner marginals, the teeth are not unlike those in some Endodontidae. Its tripartite sole is perhaps the best reason for the inclusion of this species as a primitive member in the Zonitidae. But, its very peculiar dentition and its oviducal caecum separate it from either the Tanychlamydinae or the Euconulinae, which are perhaps its closest relatives. For these reasons, *Macrocyclis hemphilli* W. G. B. is now

made the monotype of a new genus, *Megomphix,* and of a special subfamily, the Megomphicinae.

(To be continued)

Explanation of Plate 5

All figures are drawn with aid of camera lucida. Uppermost scale is for figs. 5-7 and represents one millimeter; next for figs 4 (5 mm.) and 1T (200 microns), third for fig. 2 (.5 mm.), fourth for fig. 3 (5 mm.) and lowest for fig. 1 (50 microns).

Fig. 1. *Megomphix hemphilli.* Radula: central and 1st lateral slightly separated laterad; also 7th, 14th, 21st and 23rd teeth. Hairline (T) gives shape of right half of a transverse row, with borders of each tooth indicated.

Fig. 2. *M. hemphilli.* Jaw.

Fig. 3. *M. hemphilli.* Genitalia, dissected and separated; also transverse sections through: (A) oviducal caecum between apical and middle thirds of its length, (B) vas deferens (left) and penis at their confuence and (C) vas deferens and penis a short distance below their junction (less enlarged).

Fig. 4. *M. hemphilli.* Internal view of pallial complex, pinned out nearly flat. Curved line that crosses pericardium and kidney indicates position of posterior lung-wall.

Figs. 5–7. *Pristiloma nicholsoni.* Umbilical, apical and profile views of cotype shells; fig. 6 represents a different specimen from that in figs. 5 and 7.

Plate 6

Uppermost scale is for fig. 6 and represents 1 mm., next for figs. 2-4 (1 mm.), third for figs. 1 (10 microns) and 1T (50 microns), fourth for fig. 5 (1 mm.) and lowest for fig. 7 (1 mm.).

Fig. 1. *Radiodiscus (Radiodomus) abietum.* Radula: central and 1st lateral in natural relations; also 7th, 14th and 18th teeth. Hairline (T) gives shape of right half of a transverse row with borders of each tooth indicated.

1-4, Megomphix hemphilli. 5-7, Pristiloma nicholsoni.

1–7, Radiodiscus (Radiodomus) abietum.

CHARLES J. MAYNARD

FIGS. 2–4. *R. abietum*. Umbilical, apical and profile views of type shell (immature). Peristome of specimen is broken (dotted lines inside of restored outline). In both figs. 2 and 3, outlines of two adjacent ribs are shown.

FIG. 5. *R. abietum*. Genitalia, with ovotestis and half of its duct omitted.

FIG. 6. *R. abietum*. Internal view of pallial complex.

FIG. 7. *R. abietum*. Penis and accessories, drawn from mount in glycerin jelly, as viewed by transmitted light.

CHARLES JOHNSON MAYNARD

After an illness of over two months Mr. Charles J. Maynard passed away at his home in West Newton, near Boston, October 15, 1929. He was born in West Newton, May 6, 1845.

Mr. Maynard was one of the old school of naturalists and had his own way of doing things and his own ideas regarding nomenclature and the classification of species. Primarily an ornithologist, he also wrote on the butterflies and on many other subjects pertaining to natural history. Now, however, I wish to place special emphasis on his conchological work on the Cerionidae.

In giving an account of his explorations Mr. Maynard says:—"I saw my first Cerion in November, 1870, when I collected specimens of what I then knew as *Pupa incana* on Key West." He collected at Nassau, Bahamas, in 1883, and at Nassau, Andros, Rum Key, Long Island, Inagua, Cayman Brac, and Little Cayman in 1887-88. In 1893 he again visited Nassau and Andros, and the following keys, Green and High Keys, Highburne Key and the keys about Allen's Harbor. In 1897 he explored more thoroughly the Island of New Providence and visited Eleuthera. 1913 again saw him at Nassau, but owing to an accident he was unable to carry out all his plans at that time. His most

extended trip for Cerions was in 1915. Landing at Nassau, he chartered a small vessel and visited North Silver Key, Rose Island, Ship Channel Key, Bush Key and the line of keys extending to the Exuma Keys. Returning to Nassau, Andros was again visited, also Joulter's Keys and Berry Islands to Great Stirrup Key. In referring to the material obtained Maynard says:—"As a result of all the explorations made in 1915, 100,000 Cerions were secured and among them are about ninety new species. These, and the specimens already gathered, bring the number of Cerions now in my collection somewhere in the neighborhood of 200,000." His last trip to the Bahamas was in the summer of 1924, when he collected 44,000 specimens on New Providence and adjacent islands.

With his classifications of the Cerionidae many do not agree, but a review of his work would not be in keeping at this time, even if space were available. As pointed out by Dr. H. A. Pilsbry in the Manual of Conchology and by Dr. Paul Bartsch in his "Experiments in the Breeding of Cerions", the species are excessively plastic and locally modified, and are subject to a remarkable range of individual variation. Many species vary from those having conspicuous longitudinal ribs to those that are entirely smooth. In color and size a species may also be extremely variable.

The following papers by Mr. Maynard all appeared in his own publications:

Monograph of the Genus Strophia. Contributions to Science. Vol. I, 1889, pages 1-29, 68-79, 125-135, 188-197, plates 1, 2, 7, 16. Vol. II, July, 1893, Dec., 1894, pages 107-182. Vol. III, March, 1896, pages 1-40, plates 1-7.

Descriptions of some species of the family Cerionidae, Appendix to Records of Walks and Talks with Nature, Vol. 5, pages 177-200, 1913.

A species of Land Shell of the family Cerionidae. Records of Walks and Talks with Nature, Vol. 6, pages 177-179, 1914.

Descriptions of New Strophias, by J. C. Maynard and

Nellie A. Clapp. Records of Walks and Talks with Nature, Vol. 6, pages 180-182, 1915.

Contributions to the History of the Cerionidae, Appendix to Vol. X, Records of Walks and Talks with Nature, Numbers 1-12, Oct., 1919-March, 1926, 217 pages, 43 plates and 116 figures in text.

Catalogue of Specimens of the Family Cerionidae, for sale [1921].

Supplement to Sale Catalogue of Cerionidae, with descriptions of new species, collected in the Bahamas Islands in summer of 1924, pages 1-6, December, 1924.

C. W. JOHNSON.

NOTES AND NEWS

PYRGULOPSIS NEVADENSIS (STEARNS) IN OREGON.—Recently Prof. Junius Henderson[1] announced the finding of this species inside of a shell of *Carinifex ponsonbyi* from Klamath Lake, Oregon, which I had sent to him. Sometime previously I had been sorting a large number of the *Pyrgulopsis* which had been dredged in Pyramid Lake, Nevada, and at the time of his announcement, I was afraid that one of these had accidentally gotten misplaced and wedged in the *Carinifex*. Therefore, it is fitting to announce definitely that *Pyrgulopsis nevadensis* does live in Klamath Lake, Oregon.

Dr. H. B. Baker, Mr. John Nicholson and I spent July 25 to 27, 1929, collecting about the lake and found the species living in considerable numbers at two widely separated places. One of these is a point on the east side of the lake, four and one-half miles north of Algoma; the other was on the west side of the exit, just above the bridge. In both cases the shells were found on rocks and tule roots in water

[1] Henderson, J. NAUTILUS, Vol. 41, 1928, p. 141. Also, Non-Marine Mollusca of Oregon and Washington, Univ. Colo. Studies Vol. 17, No. 2, July, 1929, p. 170.

two to five feet in depth. Careful comparison has not been made with a series from the Nevada Lakes, but they are believed to be the same species.

Mr. F. M. Anderson, who collected the *Carinifex* sent to Prof. Henderson, informs me that he obtained his shells at the south end of the lake near the exit where our living specimens were obtained.—G. D. HANNA.

PODODESMUS MACROSCHISMUS DESHAYES.—A specimen dredged in Puget Sound gives further evidence of the plasticity of this form (NAUTILUS, Vol. XLII, p. 67) in relation to its environment. This individual grew within an empty *Teredo* boring, surviving in spite of the cramped quarters. Although the typical shape is almost circular the present specimen is elongated, having the following dimensions: a record of either *Zoogenites* or *Carychium* for any of the Height (umbo to margin), 7.5 mm.; length, 21.5 mm.—DON L. FRIZZELL, Seattle, Wash.

ZOOGENITES AND CARYCHIUM IN COLORADO.—Dr. Calvin Goodrich, of the University of Michigan, recently sent me specimens of *Zoogenites harpa* (Say) and *Carychium exiguum* Say, with a fragment that seems to be the apex of *Cochlicopa*. They were obtained by Dr. Peter Okkelberg, in Estes Park, Colorado, at an altitude of a little over 8,000 feet above sea level, in sparse woods near a spring half a mile from Stead's Ranch house. I have never been able to find Rocky Mountain States, though *Carychium* has been reported from both Oregon and Washington. The finding of these two genera together, both eastern species, in an isolated western mountain park and their apparent absence elsewhere in the whole surrounding region, suggests the possibility that they were inadvertently introduced in shipments of some sort from some other state, but the situation and locality makes that seem improbable. It is probably a perfectly good record of a natural occurrence, and is very interesting. I have always expected that *Carychium* would eventually be found in the Rockies, but did not expect *Zoogenites* in Colorado.—JUNIUS HENDERSON.

LITORINA LITTOREA LINN.—Richards (NAUTILUS, Vol. 43, p. 65, 1929), states that this species is a rock-inhabiting form exclusively, and not found elsewhere. Exception must be made to this statement. The species in question is one of the most abundant forms found along the shores of bays and inlets on the New England coast. In this region they can be found everywhere between tide marks crawling over mud and on the blades and among the roots of *Zostera*. In many places it is by far the dominant species. No other littoral mollusk on the New England coast is to be found in so many different habitat stations.—W. J. CLENCH.

NEW SHELLFISH LAW FOR MASSACHUSETTS.—Director William C. Adams of the State Division of Fisheries and Game, has given out the following statement: "The new law pertains to the taking of shellfish by any inhabitant of the commonwealth for his own family use. Heretofore any resident could take an unlimited quantity of shellfish from any of the costal areas of the commonwealth but under the terms of the new law he is restricted to not exceeding one-half bushel of quahaugs or soft-shelled clams, including shells, in any one day; or more than one bushel of each, including shells, in any one week. In the case of scallops the public is limited to one and one-half bushels of scallops, including shells, in any one week and there is a further restriction that scallops can be taken only during the open season from Oct. 1 to April 1.

"In addition to the foregoing, the law provides that no quahaugs or clams which are less than two inches in length at longest diameter may be taken by any person, regardless of whether or not they are taken for family use or commercial purposes."

PUBLICATIONS RECEIVED

THE TERRESTRIAL SHELL-BEARING MOLLUSCA OF ALABAMA. By Bryant Walker (Univ. of Michigan, Mus. Zool., Misc. Pub. No. 18). Herbert H. Smith, assisted by his

talented wife, collected mollusks in Alabama from 1903 until his death in 1920. In this rich field, which had been worked over in places by Conrad and by Showalter and other correspondents of Dr. Isaac Lea, Smith covered the ground much more effectively, collecting not only copious materials for elucidating the old species, but also many new forms of the greatest interest. Many of his discoveries were published from time to time in the NAUTILUS and elsewhere, by Walker and G. H. Clapp, and Goodrich has worked on the Pleuroceridae. Now we have a treatise on the land shells of the state from Bryant Walker's capable pen.

No less than 23 new species and subspecies of land shells were discovered by Smith. Since Alabama extends from the outliers of the Appalachian Plateau to the Gulf, its fauna is remarkably varied. Walker recognizes 150 species of the northern fauna, 35 of the southern. Two thirds of the latter are confined to the Gulf coast. Probably no other state has so many species of Polygyra, 59. The following new forms are first described in this work:

Polygyra herberti Walker.
Vitrea cumberlandiana Clapp.
Vitrea (Paravitrea) smithi Walker.
Anguispira alternata crassa Clapp.
Anguispira alternata macneilli Walker.
Anguispira alternata palustris Clapp.
Anguispira alternata smithi Walker.
Vertigo whecleri Pilsbry.

The 278 figures accompanying the descriptions of species and subspecies add materially to the usefulness of the paper. It is handsomely printed, and being the only handbook we have dealing with a southern state, is a most welcome addition to our list of regional manuals.— H. A. P.

SOME RECORDS AND DESCRIPTIONS OF THE NEW FRESHWATER MOLLUSKS FROM CAMEROON. By William J. Clench. (Bull. Museum Comp. Zool., Vol. 59, pp. 117-123, pl. 1, 1929.) One new genus *Goodrichia* and the following new

species are described and figured: *G. trochiformis* and subspecies *pilsbryi*, *Rhinomelania africana*, *Lanistes sanagaensis* and *Egeria schwabi*.

A CONTRIBUTION TO OUR KNOWLEDGE OF THE ANATOMY OF THE FRESH-WATER MUSSELS OF THE DISTRICT OF COLUMBIA. By Lucy Reardon. (Proc. U. S. Nat. Mus., Vol. 75, art. II, pp. 1-12, pls 1-5, 1929.) The anatomy of five species is described and figured in detail. A valuable contribution to our knowledge of the species.

FAUNA MALACOLOGICA TERRESTRE Y DE AQUA DULCE DE CATALUÑA. Por el Dr. F. Haas. (Trab. Mus. Cien. Nat. Barcelona, vol. 13, 1929.) A most exhaustive study of the molluscan fauna of northeastern Spain. The work comprises 491 pages with 187 excellent figures in text.

NEW FOSSIL LAND AND FRESH-WATER MOLLUSKS FROM THE REYNOSA FORMATION OF TEXAS. By Wm. B. Marshall. (Proc. U. S. Nat. Mus., Vol. 76, art. 1, pp. 1-6, pl. 1, 1929.) Three new genera *Pliconaias*, *Eonaias* and *Antediplodon* and four new species including *Polygyra myersi* are described and figured.

THE FLORIDA TREE SNAILS OF THE GENUS LIGUUS. By Charles T. Simpson. (Proc. U. S. Nat. Mus., Vol. 73, art. 20, pp. 1-44, map, and pls. 1-4, 1929.) A most interesting review of this remarkable genus, in which the author figures the various forms described in the Proc. Biol. Soc. Washington, vol. 33, 1920, together with others described by Dr. Pilsbry. The authors' views on the dispersal of these tree snails from Cuba, on floating timber, during hurricanes and their distribution and migration in Florida forms a very interesting chapter. The author says: "The death knell of these beautiful snails in Florida has been sounded and it will be but a few years until all are gone, save it may be in the great Royal Palm Hammock which is a state reservation. Most of the small hammocks have been destroyed, and in others still standing the snails are fading away before man." The colored plates are very good but hardly do justice to these beautiful shells.—C. W. J.

SHELLS OF PEITAIHO. By Amadeus W. Grabau and Sohtsu G. King. Published by the Peking Laboratory of Natural History. 279 pages, 11 plates, 2nd ed., 1928. Peitaiho is on the Bay of Pechili, China. The physical features of the collecting ground, how to collect and other interesting matter is given in the introduction. Chapters on the structures of pelecypod and gastropod shells, are followed by the systematic descriptions of species. 127 species are described and figured, of which 43 species and varieties are new. The following from the preface fully describes the object of this valuable guide to the study of the Mollusca. "In reissuing this book in its new form, we are actuated by the desire to make it a handy field-companion for the multitude of young and mature students, who have come to realize that some of nature's most beautiful objects are to be found upon the unique shores of Pechili Bay."—C. W. J.

NON-MARINE MOLLUSCA OF OREGON AND WASHINGTON. By Junius Henderson (University of Colorado Studies, XVII, No. 2, 1929). To supply the need for a faunal work on the inland mollusks of the region, Professor Henderson has published this excellent manual of 190 pages, in which may be found descriptions, figures and details of distribution of all species now known in these states, together with references to previous literature. The author has visited 225 localities in the two states in the past three years. He has critically examined the evidence in cases of records which appear dubious, and has given careful attention to the ever-changing nomenclature. The characteristics and limits of the Oregonian and the Washingtonian "provinces" are discussed briefly. "In a general way these provinces are so distinct in their biological characteristics as to strongly impress anyone who is working upon the mollusks in a large way." The figures, many of which are original, are characteristic, and the work will be most useful to all concerned with the zoology of the region.—H. A. P.

THE NAUTILUS.

Vol. XLIII APRIL, 1930. No. 4

ANCIENT SHELL "TRADE ROUTES"

BY JUNIUS HENDERSON

It has long been known that large quantities of Pacific marine shells are found in prehistoric graves and ruins in Utah, Arizona, New Mexico and southwestern Colorado. *Olivella*, *Haliotis* and *Glycymeris* are especially abundant, and are found with remains representing all the culture periods, from the very abundant Basket Maker to the Pueblo-Cliff Dweller. Fine necklaces and armlets made of *Glycymeris* and *Olivella* and ornaments made of *Haliotis* have been found in Basket Maker graves. Two of these are in the University of Colorado Museum. It seems probable that there was for at least 2,000 or 3,000 years a regular trade route for shells from southern California or Lower California, or both, to Colorado and New Mexico. A recent paper by Krieger ("A prehistoric pit house village site on the Columbia River at Wahluke, Grant County, Washington," Proc. U. S. Natl. Museum, LXXIII, pp. 1-29, 1928) indicates that there was a similar ancient trade route, either over the mountains or up the Columbia River, from the Pacific Coast to interior Washington, the sites mentioned in the paper being over 200 miles in a direct line from the coast. He mentions *Dentalium indianorum*, *Haliotis kamchatkana*, *H. fulgens*, *H. rufescens*, *Diadora aspera* *Olivella biplicata*, *Glycymeris subobsoleta*, *Protothaca* sp., and "other Pacific Coast shells".

He mentions *Protothaca* as a "Columbia River species of

bivalve" (p. 13), a "fresh-water clam or Unio" (p. 15). It is not a *Unio* and not a fresh-water clam, but a subgenus of *Paphia*, or perhaps a genus, including several species and subspecies widely distributed along the Pacific Coast and about Puget Sound, usually abundant in estuaries or bays where the water is markedly saline, but more or less freshened by the inflow of river water. The *Dentalium* is probably what is now known as *D. pretiosum* Sowerby. I have found no record of *H. fulgens* north of the Farralones, or of *H. rufescens* north of Bodega Bay, the northern limits of those species, according to Dall (1921), and have not found them myself in extensive collecting along the coasts of Washington and Oregon. If they occur they must be very rare. All of the other species may well have come from the coast of Washington or Oregon, by any one of several feasible routes.

If the material called *H. fulgens* and *H. rufescens* is correctly identified, it raises a difficult question as to where it came from. It does not seem likely that it came from middle or southern California. It does not seem any more likely that during the few centuries or possibly 2,000 or 3,000 years since the burials were made the ranges of the two species have been so restricted. It might be possible that they are fossil shells, but I have never found any of either species in the fossil deposits of the northwest that I have examined, nor have I seen any recorded from there. There are numerous Pleistocene deposits about Puget Sound and southward along the coast which should contain specimens if the species formerly lived along the northwest coast. If these shells came from the Oregon or Washington coast and their range has since been much restricted it would be at least some evidence bearing upon the antiquity of the human remains associated therewith.

HELICINA (HENDERSONIA) OCCULTA SAY, AGAIN

BY B. SHIMEK

Morrison's recent paper on *Hendersonia occulta*[1] invites discussion.

As is well known, the fossil form was described by Say as *Helicina occulta*. Later, Green described the modern form as *H. rubella*. The paper noted follows the tendency to regard the modern form as a variety of *occulta* under the name *rubella*.

The writer has previously shown that there is no warrant for the separation of the modern and fossil forms.[2]

Color cannot be a criterion, for the fossil shells are bleached, and the modern forms vary greatly, from light horn-colored, through lemon-colored and light red, to a deep brick red. Size is variable in both, and the extremes in one equal those in the other. The form of the shell is also variable in both, within about the same limits.

To separate the living form as a named variety gives an impression of differences which do not exist. If this rule is to be followed then *all* the fossils from the loess should be segregated under separate names,—a procedure which has already gone too far. Manifestly there is no excuse whatever for a varietal separation of the fossil and modern forms where both exhibit the same range of variation. The varietal name *rubella* should be dropped.

The statement is also made that "nearly all the records of the occurrence of this species as a modern form are from the Driftless Area of southwestern Wisconsin, northeastern Iowa and southeastern Minnesota and from the Appalachians".

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[1] Morrison, J. P. E., *On the Occurrence of Hendersonia in Crawford County, Wis.*, NAUTILUS, XLIII, 41-45; 1929.

[2] For the writer's discussion of variation and distribution of the fossil and modern forms see: *Helicina occulta* Say, Proceedings of the Davenport Academy of Sciences, vol. IX, pp. 173-180; 1904. *Additional Notes on Helicina occulta*, Journal of Geology, vol. XIII, pp. 232-237; 1905. *Further Notes on Helicina occulta* Say, Proceedings of the Iowa Academy of Science, vol. XXVI, pp. 385-390; 1919.

In this northern territory the modern form has been found most abundantly in Johnson and Madison counties, Iowa, both far removed from the so-called Driftless Area (which, incidentally, was not wholly driftless in Iowa and some of the adjoining territory), and it occurs in Iowa in Linn, Hardin and Lee Counties, and in Mound County, Illinois,—all remote from the Wisconsin Driftless Area.

The southern limit of distribution of the modern form is in Marion County, Tennessee, which is almost exactly the southern limit of the fossil form. Here it is associated with a distinctively southern molluscan fauna.

It is significant, moreover, that as we approach the Driftless Area the fossils of this species become less and less common until they disappear before reaching this area which is assumed to be one of the centers of distribution of the modern form. It might appear, rather, that the colonies in the Driftless Area are later invaders, though the lesser deposition of loess in that region would probably make the preservation of the shells less certain.

The fossil shells are widely distributed in the Loess, occurring from Indiana to Nebraska, and south to near the south line of Tennessee on the east side of the Mississippi, though not known south of Missouri on the west side of the river. Southward it is displaced, in both the loess and modern faunas, by *Helicina orbiculata*.

The widely scattered modern colonies are evidently remnants of a once abundant race, but we must look to other than glacial causes for their reduction in numbers. Both the fossil and modern forms extend far south of the limits of glaciation, and the reduction in numbers and extent of local distribution has been distinctly greater in the southern part of the area.

Iowa City, Iowa, January 20, 1930.

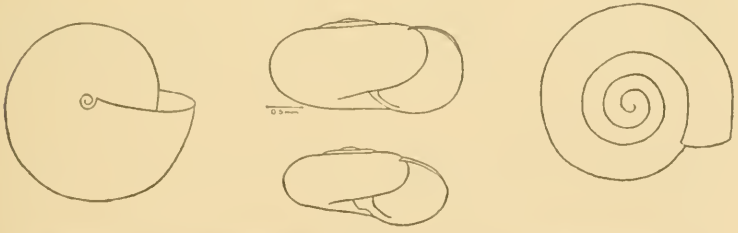
SNAILS, NEW AND OTHERWISE, FROM THE PALOMAR MOUNTAINS, CALIFORNIA

BY S. STILLMAN BERRY
Redlands, California

The following apparently new species of zonitid land snail was among the spoils of last season's collecting.

VITREA OROTIS, new species. (Figs. 1, 1*a*, 1*b*.)

Diagnosis:—Shell small, thin, whitish horn-color, translucent. Whorls 3¾, moderately convex, regularly enlarging, smooth, except for the weak incremental lines, and the traces of spiral striation noted below. Surface highly polished, with a waxy luster; occasional whitish resting marks on most specimens, and sometimes also whitish spirals in the shell. Suture distinct, appressed; spire very low-conic; base convex, umbilicate; umbilicus wide and with the earlier whorls perspectively visible within, contained about



FIGS. 1, 1*b*.—*Vitrea orotis*. FIG. 2, below.—*Vitrea shepardi*. Camera outlines.

5 times in the shell diameter; periphery rounded. Aperture rounded, moderately descending, the lip sharp, and with a slight subangulate reflection at the umbilicus. Spiral striation quite strong in umbilicus, and also very finely and delicately developed on the upper surface, where, however, it is not always easy to make out.

Max. diam. of type 2.60, min. diam. 2.24, alt. 1.36, diam. umbilicus .52 mm.

Type:—Cat. No. 7095 of the author's collection. Paratypes No. 6552 of the same collection, others to be deposited

in the San Diego Museum of Natural History and the Academy of Natural Sciences of Philadelphia.

Type Locality:—Near the sawmill on south ridge of Palomar Mountains, east of Palomar resort, San Diego Co., California; in woodsy ravine under fallen logs and bark; 19 specimens, S. S. Berry and Willis G. Craig coll., 7 April 1928.

Remarks:—This minute but very beautiful snail, in form, color, and texture, suggests *V. gabrielina* (Berry), its not distant neighbor to the north, and especially *V. shepardi* (Hemphill), but the much smaller size, the fewer whorls, and the wider, more perspective umbilicus serve amply to distinguish it from the former, while if my single specimen of *shepardi* from False Bay be correctly identified, the latter is a flatter, more lenticular shell with a more oval aperture. In specimens taken alive the umbilicus was almost invariably occluded by a translucent film resembling dried slime as in the preceding species.

The reference of both these forms, as well as *gabrielina*, to *Vitrea* must be understood as purely presumptive, pending such time as an investigation may be made of their anatomical characters.

The specific name chosen is derived from öros mountain, + the suffix—tis, inhabitant of.

The following species was found in association with the one just described.

Helminthoglypta lowei (Bartsch). This handsome form seems to be entirely distinct from *cuyamacensis*.

Zonitoides (*Zonitellus*) *arboreus* (Say).

Vitrea chersinella (Dall).

Striatura milium meridionalis (Pilsbry & Ferriss). This form is not typical *milium* and seems best referred to the Arizonan subspecies in the present state of our knowledge.

(Note: Since the foregoing paper left my hands Mr. H. B. Baker has kindly made direct comparison between paratypes of *V. orotis* and some of Hemphill's originals of *V. shepardi* from Santa Catalina Island [A. N. S. P. 86664]. He writes that "*shepardi* is about the size of *orotis*, but is decidedly more lenticular, with more depressed, more rapidly increasing whorls [½ whorl less in similar diameter], with a relatively smaller umbilicus and with a slightly impressed suture.")

THE MICRARIONTAS OF THE INDIOENSIS GROUP, WITH THE DESCRIPTION OF A NEW SUBSPECIES

BY G. WILLETT

During the past few years the writer has accumulated a series of specimens of Micrarionta from many localities on the desert slope of the San Jacinto Mountains and their southerly extension, the Santa Rosas. After a study of these specimens, it seems possible to deal more definitely with the relationships between the various forms, and their geographical distribution. The conclusions arrived at are incorporated in the following paragraphs.

Micrarionta indioensis indioensis (Yates). This, the first known of the helicoids of the vicinity, occurs in its typical form from near Indian Wells, Riverside County, California, an undetermined distance southward. Specimens are at hand from La Quinta; Coral Reef, west of Thermal; one and one-half miles south of Coral Reef, and Fish Traps, west of Mecca. Examples from the immediate vicinity of Indian Wells seem variously intermediate between typical *indioensis* and the next form.

Micrarionta indioensis xerophila Berry. This rather slightly differentiated form occurs from a short distance north of Indian Wells to the southern side of Cathedral Canyon, specimens having been taken from a number of different localities within this range. It differs from typical *indioensis* principally in being slightly more depressed; also, it may average somewhat smaller.

Micrarionta indioensis cathedralis, new subspecies. Description.—Shell of about five whorls, moderately elevated, umbilicated: tan-colored, with dark brown stripe, from one-half to three-fourths of a millimeter in width, on shoulder of the last one and one-fourth whorls, a more or less indistinct lighter zone on either side of the brown band. Early whorls thickly papillated in diagonal rows, these papillations becoming less conspicuous and more scattered on the later whorls and apparently absent on the last half of the

last whorl and on the base, the latter being marked only with irregular growth lines. Aperture oval, oblique, strongly and rather abruptly descending: outer lip and columella well reflected, the reflection of the latter covering about one-half of the umbilicus.

Type, No. 1022 Collection Los Angeles Museum. The type and ten additional specimens were collected by the writer and his wife in rock slides at the head of Cathedral Canyon, Riverside County, California, February 8, 1930. Paratypes are in the collection of the writer. The type, which is the largest of the series, measures as follows: max. diam., 20 mm.; min. diam., 16 mm.; height, 13 mm.; whorls five.

Remarks:—this form is admittedly an intergrade between *M. indioensis* (Yates), and *M. wolcottiana* (Bartsch), being approximately half way between the two in size, as well as in the reflection of the columellar lip. It is, however, so different from either that it seems fitting to give it a name. The intergradation between *cathedralis* and *xerophila* takes place along the south side of Cathedral Canyon, and along the north side of the same canyon, towards Palm Springs, it gradually merges into the next form.

Micrarionta indioensis wolcottiana (Bartsch). This well known shell, the largest in the *indioensis* group, occurs in its typical form along the San Jacinto Range, from Palm Canyon to Snow Creek. Southward from Palm Canyon it intergrades with *cathedralis*.

Los Angeles Museum, Los Angeles, California, Feb. 11, 1930.

A NEW COLOMBIAN HELICID SNAIL OF THE GENUS LEPTARIONTA

BY H. A. PILSBRY

LEPTARIONTA MAXWELLSMITHI, new species.

Acandi, Colombia, on leaves of bananas. Type No. 150243 ANSP, presented by Mr. Maxwell Smith.

The shell is imperforate, trochiform, acutely carinate; thin; grayish white under a very thin, faintly yellow periostracum, with a narrow brown band near the middle of the whorls of the spire, failing on the last whorl, and a brown line immediately below the suture, widening into a comma-shaped spot at the apex; on the base there is a wider carob brown band a short distance below the

Fig. 1. Leptarionta maxwellsmithi.

peripheral keel; there is a small dark spot above the keel behind the expansion of the lip. The first two whorls are convex, the rest nearly flat, the last whorl being slightly concave above and below the acute keel, and not in the least descending in front. The base is nearly flat. The first whorl is smooth and glossy; the later whorls are smoothish, less glossy, and show low, unequal ripples of growth, which are a little stronger on the base. The aperture is angular outwardly, the peristome white, upper margin slightly curved forward, expanded and thin, the basal margin arcuate, reflected, at the axis dilated over the umbilical region.

Height 18 mm., diam. 25.2 mm.; 4½ whorls.

This is the first South American species of the genus. It is nearest to the Costa Rican *L. zhorquinensis* (Angas), but differs in the imperforate base, the lower, wider shape, wider aperture, the smaller number of whorls and the smoother surface, *L. zhorquinensis* being minutely roughened.

In another and imperfect specimen the band in the middle of the upper surface extends upon the last whorl to the lip, and there is no dark spot behind the lip above the keel (right hand figure).

NOTES TAKEN IN THE VICINITY OF VINTON, IOWA

BY DAVID T. JONES

Research Laboratory of Biology, Marietta College, Marietta, Ohio

The following list represents collections made in the region of the author's home during the summers of 1926 and 1928. The author is under obligation to Dr. Calvin Goodrich for aid in identifying *Helicina occulta* and *Pomatiopsis lapidaria*, to Dr. Bohumil Shimek for several Iowa specimens from other localities for comparison, and locally to Ronald Leemon, William Franklin, and Glenn Bordwell for aid in collecting.

Polygyra hirsuta (Say), Goarcke's Lake, West Bluffs, City Park (Vinton).

Polygyra fraterna (Say), Goarcke's Lake, East Bluffs, City Park, West Bluffs.

Polygyra multilineata (Say), Stony Cut, Goarcke's Lake, Pratt Creek, City Park, East Bluffs, Mud Creek.

Polygyra profunda (Say), City Park, Goarcke's Lake, East Bluffs, Stony Cut.

Polygyra zaleta (Binney), City Park.

Strobilops labyrinthica (Say), West Bluffs.

Gastrocopta armifera (Say), City Park, West Bluffs, City of Vinton.

Gastrocopta contracta (Say), West Bluffs, East Bluffs.

Gastrocopta pentodon (Say), West Bluffs.

Cochlicopa lubrica (Müller), Goarcke's Lake, City Park, West Bluffs.

Retinella hammonis (Strom), City Park, West Bluffs, Jones' timber.

Glyphyalina indentata (Say), City Park, West Bluffs.

Euconulus fulvus (Müller), West Bluffs.

Zonitoides arboreus (Say), West Bluffs, Jones' timber, City of Vinton, Goarcke's Lake, City Park.

Pseudovitrea minuscula (Binney), West Bluffs, East Bluffs.

Agriolimax campestris (Binney), Goarcke's Lake, West Bluffs, City of Vinton.
Anguispira alternata (Say), City Park, East Bluffs.
Helicodiscus parallelus (Say), West Bluffs, Jones' timber, East Bluffs, City Park, Goarcke's Lake.
Punctum pygmaeum (Draparnaud), West Bluffs.
Succinea avara Say, West Bluffs.
Succinea ovalis Say, City Park, Goarcke's Lake, Mud Creek.
Succinea retusa Lea, West Bluffs.
Carychium exiguum (Say), West Bluffs.
Stagnicola caperata (Say), Goarcke's Lake.
Fossaria modicella rustica (Lea), West Bluffs.
Heliosoma trivolvis (Say), West Bluffs, Dudgeon Creek, Goarcke's Lake, Mud Creek.
Gyraulus parvus (Say), West Bluffs.
Planorbula crassilabris (Walker), West Bluffs.
Physella gyrina (Say), West Bluffs, Mud Creek, Lake on Isben Noble farm.
Physella integra (Hald.), Goarcke's Lake.
Pomatiopsis lapidaria (Say), West Bluffs.
Helicina occulta Say, East Bluffs.
Musculium secure (Prime), Goarcke's Lake, West Bluffs.
Musculium truncatum (Linsley), West Bluffs.
Pisidium abditum Haldeman, West Bluffs.

Three habitats are worthy of mention. In a hillside swamp below a spring at West Bluffs *Pomatiopsis lapidaria*, *Strobilops labyrinthica*, *Euconulus fulvus*, *Polygyra hirsuta*, *Succinea retusa*, *Succinea avara*, *Zonitoides arborea*, *Gastrocopta contracta*, *Pisidium abditum*, and *Agriolimax campestris* were found living together. In a pond further north and at the foot of the same bluff *Succinea retusa*, *Physella gyrina*, *Planorbula crassilabris*, *Musculium truncatum*, and *Fossaria modicella rustica* were found. *Helicina occulta* was found alone, under stones, high up on the hill just north of the old stone quarry at East Bluffs. Two dozen specimens were taken. The boundaries of the colony were very limited.

A NEW PLEISTOCENE FOSSIL FROM PORT BLAKELY, WASHINGTON

BY DON L. FRIZZELL

Seattle, Washington

PAPHIA RESTORATIONENSIS, new species.

Shell large and heavy, subquadrate, convex; surface sculptured by numerous rather fine but conspicuous radiating lines and a few raised, irregular, discontinuous concentric lines, the former markedly wider at both anterior and posterior ends, the latter high and most prominent on the anterior part of the shell; a very thin epidermis seems to have been present, although almost completely eroded on type; no lunule present; inner margins smooth; hinge long, rather narrow, greatly arched; three teeth in each valve, the posterior two in the right valve and the middle one in the left valve bifid; pallial sinus long, narrow and rounded. Length 96.7, height 74.3, thickness 45.3 mm. *Holotype:*—No. 1001, Coll. D. L. F.

Occurrence:—Fairly common in late Pleistocene beds at Restoration Point, near Port Blakely, Washington, and extremely rare living in Puget Sound. (Reported by Professor Trevor Kincaid of the University of Washington).

Remarks:—This species is intermediate between *Paphia staminea* and *P. tenerrima* and may be a subspecies of the latter. It is given provisional specific ranking, however, until its exact relations may be determined. It is very much like *tenerrima* in size and outline but is distinguished by its greater heaviness, greater thickness, greater height and more arched hinge and in the pronounced radial sculpture. It is similar to *staminea* in the widely arched hinge and in the radial sculpture but is easily distinguished by the lack of crenulated inner margins, the larger size and greater length in comparison to height.

This form is very distinctive and can be instantly recognized. It does not fit into the series of *tenerrima* from the same locality and the seventeen specimens collected justi-

fy, in my opinion, a description and name for this species. It is possible, further, that this may have some stratigraphic significance, occurring as it does rather commonly in the late Pleistocene and so rarely living.

NEW AND PROBLEMATIC WEST AMERICAN LAND SNAILS

BY H. BURRINGTON BAKER

(Continued from p. 101)

PRISTILOMA NICHOLSONI, new species.

Shell (pl. 5, figs. 5-7): minute, rimate, thin, vitreous. Color: light horn, almost white. Whorls: 4 ¼, quite rapidly increasing in diameter, well rounded, although slightly flattened above; suture beveled over each preceding whorl so as to appear broadly margined. Apical whorls: apparently smooth. Sculpture of later whorls: growth-lines irregularly spaced, faintly impressed, slightly stronger on umbilical side and very weakly arcuate at suture; spiral striae weak and closely spaced (somewhat like in *Zonitoides arboreus*). Umbilicus: small and rendered rimate by peculiarly expanded columellar angle of peristome. Aperture: narrowly crescentic and nearly vertical. Peristome: sharp and simple on palatal and basal sides, but expanded towards columellar angle, which is free from preceding whorl so that it forms a triangular tongue which almost hides the umbilicus.

Cotype (figs. 5 and 7): alt. 1.08 mm., maj. diam. 187 (2.02 mm.), min. diam. 169 (1.82), alt. apert. 90 (.97), diam. apert. 101 (.98); apical whorls eroded. Another cotype (fig. 6): alt. 1.05 mm., maj. diam. 196 (2.06), min. diam. 175 (1.84), alt. apert. 89 (.94), diam. apert. 104 (.98); 4 ¼ whorls.

Type Locality:—Under pieces of wood on hillside near spring brook (first small branch below Big Carson Creek)

about two miles south of Lagunitas, Marin County, California; collected by Mr. John Nicholson of the California Academy or Sciences and myself on July 19, 1929 (No. 149978, in Acad. Nat. Sci. Philadelphia).

In general appearance, this species is most like *Vitrea johnsoni* Dall (1895, Naut. 9: 27), from Seattle, Washington, which was named from incompletely developed specimens (paratypes examined) of what was later much more recognizably described as *Pristiloma taylori* Pils. (1899, Proc. Acad. Nat. Sci. Philadelphia 51: 185, pl. 9, figs. 6-8), from Nanaimo, Vancouver Island. But, when adult, *P. johnsoni* has more rapidly expanding whorls than the Californian species and is imperforate, while the columellar expansion of *P. nicholsoni*, although similar in shape, is depressed below the umbilicus so as to leave an open rima.

In order to estimate the systematic position of this and related species, I have made preliminary dissections of topotypes of *Zonites stearnsi* Bland (1875, Ann. Lyc. Nat. Hist. N. Y. 11: 76, fig. 3) from Astoria, Oregon, which is now designated as the type of *Pristiloma* Ancey (1887, Conch. Ex. 1: 54). *Anceyia* Pilsbry [1887? (certainly after Dec. 28, 1886), Conch. Ex. 1 (6) : 26], which has been recently revived for this genus, is preoccupied by *Anceyia* Mabille [1886! (Aug. 14 séance the last one reported), Bull. Soc. Philom. France (7) 10: 128]. The anatomy of *Pristiloma stearnsi* is remarkably similar to that in the European genus *Vitrea* Fitz., but the genitalia of the American species have a large, sausage-shaped spermatheca, the apex of which does not quite reach the aorta. For the present, the two genera had best be kept separate, but *Pristiloma* is certainly more closely related to *Vitrea* than to the other American Vitreinae (*Pseudovitrea*, *Paravitrea*, etc.).

I have also examined the anatomy of topotypes of *Hyalina subrupicola* "Dall" Packard (1877, Bull. U. S. G. and G. Surv. Terr. 3, No. 1: 163, fig. 7), from Clinton Cave, near Lake Point, Tooele Co., Utah, which is the monotype

of *Ogaridiscus* Chamberlin and Jones (1929, Bull. Univ. Utah 19, No. 4: 96). The structure of *P. subrupicola* is, in the main, like that of *P. stearnsi*, but the spermatheca is of the ordinary long type. Of course, Chamberlin and Jones would have more closely approximated the true systematic relationships, both on conchological and on anatomical grounds, if they had used *Vitrea* for *P. subrupicola*, instead of adopting it for *Retinella* (*Glyphyalinia*) *indentata* (subfamily Zonitinae). Nevertheless, unless intermediate characters are found in the other species, *Ogaridiscus* seems to require at least sectional recognition. It probably includes: *P. johnsoni* (Dall), *P. nicholsoni*, *P. subrupicola subrupicola* (Dall), *Vitrea subrupicola spelaea* Dall (1895, Naut. 9: 27) from Cave City, Calaveras Co., Cal., *Zonites shepardi* "Hemphill" W. G. B. (1892, Bull. Mus. Comp. Zool. 22, No. 4, 167) from Santa Catalina Island, Cal., and *Polita gabrielina* Berry (1924, Naut. 37: 130, fig. 3), from San Gabriel Mts., San Bernardino Co., Cal. I have examined a dried animal from a paratype of *Pristiloma gabrielinum;* its radula is similar to that in the other members of the genus and its sole appears to be undivided. The first three species, at least, are more or less subterranean in habits; *P. johnsoni* usually lives on the surface of buried rocks in fairly fresh dirt and rock-slides (*Oregon:* South Oswego, Clackamas Co.; Riverdale, Multnomah Co.; near Astoria, Clatsop Co. *Washington:* Point Ellis, Pacific Co.; McAleer Creek, near Seattle, King Co.; just north of mouth of Quillayute River, Clallam Co.).

PRISTILOMA CHERSINELLA WASCOENSE (Hemphill).

Tonites (*Conulus?*) *wascoensis* Hemph. (1911, Trans. San Diego Soc. Nat. Hist. 1: 102), Wasco Co. and near Salem, Marion Co., Oregon.

?Polita chersinella Berry (1919, Proc. Acad. Nat. Sci. Philadelphia 71: 196, 199, 203), Glacier National Park, Montana (ANSP No. 115650).

Additional localities (?): along creek east of Meadows (old town), Adams Co., Idaho; ANSP 82339, Big Payette

Lake, Boise Co., Idaho (Rev. E. H. Ashmun!); ANSP 82367, Price Valley, Weiser Canyon, Washington Co., Idaho (Rev. E. H. Ashmun!).

The only distinctive feature in Hemphill's description is his remark that *wascoensis* is very similar to *chersinella*, but is about half the size with the same number of whorls. This also fits the Idaho specimens cited above, while the Montana shell is slightly larger, although still much smaller than topotypes of typical *Helix chersinella* Dall (1866, Amer. Jour. Conch. 2: 328, pl. 21, fig. 4) from Big Trees, Calaveras Co., Cal. I can present no proof of intergradation between *wascoense* and *chersinella*, but prefer not to recognize the former as a distinct species until someone has competently described and accurately figured the types.

A large series of shells from near Ouxy, on the east shore of Upper Klamath Lake, Klamath Co., Oregon, collected July 28, 1929, average slightly higher than typical *chersinella* but attain the same size. I have dissected one of these and, although not quite mature, it certainly belongs to *Pristiloma*, but has the long type of spermatheca, like *P. subrupicola*. In shell characters, *P. chersinella* combines the thicker epidermis and quite close whorls of *Pristiloma* s. s., with an open umbilicus like most species of *Ogaridiscus*. I have additional animals from the type locality and elsewhere in the Sierra Nevadas and hope to make more detailed dissections in the near future.

PRISTILOMA ARCTICUM (Lehnert).

Additional localities: Paradise Valley (near timberline on Mt. Ranier) down to near Longmire (5,000-3,000 ft.), Pierce Co., Washington.

Through the kindness of Dr. G. D. Hanna, I have been able to compare these specimens with Alaskan examples and can detect no salient differences.

RADIODISCUS (RADIODOMUS) ABIETUM, new subgenus and species.

Shell (pl. 6, figs. 2-4): small (6.7 mm.), subdiscoid, umbilicate, thin, but with heavy, almost opaque epidermis.

Color: light chocolate-brown. Whorls: maximum 5¾, gradually increasing in diameter, well rounded but markedly flattened above; last slightly descending; suture deep. Embryonic whorls: 2 to 2¼; spiral ridgelets prominent, closely spaced (14 visible) and beginning at very apex. Sculpture of later whorls: growth-riblets quite low but angular and sharply defined, markedly and broadly concave below periphery, protractive near umbilicus, scarcely arcuate near suture; interspaces 2-3 times as broad as riblets; spiral striae (with interstitial ridgelets) very closely spaced, fine but deep and sharp in interspaces, usually obliterated at summit of riblets. Umbilicus: about 6.1 times in maj. diam. of shell; with almost vertical walls. Aperture: crescentic, slightly oblique (about 20° from axis of shell). Peristome: simple and sharp, quite deeply and broadly concave below periphery; parietal callus weak.

Type (immature):—alt. 2.61 mm., maj. diam. 187 (4.89 mm.), min. diam. 177 (4.61), alt. apert. 79 (2.07), diam. apert. 113 (2.33); 5 whorls. Largest paratype (broken): maj. diam. 6.7 mm.; 5¾ whorls.

Type Locality:—Estivating (near end of driest summer in history of region) on surface of partially buried rocks, at base of a steep slope near mouth of East Fork of Weiser River, on Stevens Ranch (alt. 3,600 ft.), Adams Co., Idaho, (No. 149979, Acad. Nat. Sci. Philadelphia). Other localities: east of Meadows (old town) and south of New Meadows, in valleys at headwaters of Little Salmon River (alt. 4,000-4,500 ft.), in same county.

Stevens Ranch is near the lower limit of the conifer zone. The crests of the ridges and the most exposed slopes are covered with bunch-grasses; the less exposed slopes develop open stands of rock pine; the more protected valley-sides are dominated by Douglas fir, mixed locally with larch; while the bottom of the canyons are characterized by a white-barked fir (*Abies* sp.), blue spruces and, along the creeks, alder and red dogwood. The snails are mainly near the streams. Stevens Ranch is also the type locality

of *Pristiloma idahoense*, which estivates in about the same places as *R. abietum*. *Microphysula ingersolli* buries itself more deeply in the same rock-piles, but *Zacoleus idahoensis* (often mummified by the extreme drouth), *Polygyra ptychophora* and *P. mullani olneyae* are usually nearer the surface. *Anguispira kochi occidentalis* is also very common along Goose Creek, near Meadows, where the forest is more dominant.

Although its shell-sculpture is as usual in the genus, *Radiodiscus abietum* is much larger than the other North American species. In addition its spire is more nearly flat, its umbilicus is relatively smaller and its growth-riblets are more curved than in *R. millecostatus*. An adult (5½ whorls) from Goose Creek valley and another (5¼ whorls) from the headwaters of the Little Salmon furnish data for anatomical comparison with *R. millecostatus costaricensis* (H. B. B.: 1927, Proc. Acad. Nat. Sci. Philadelphia 79: 230, pl. 17, figs. 21-24) and with *R.* (*Radioconus*) *bactricola* (op. cit.: 231, pl. 17, figs. 25-30). Only divergent details are stressed.

Animal: sides of foot slightly pigmented; head and tentacles black. Mantle collar (pl. 6, fig. 6): similar to *bactricola*. Lung: over three times as long as its base and about four times length of kidney; wall mottled with black. Heart: relatively small; auricle broad and short; principal vein passes ventral to ureter and dorsal to tip of kidney; minor venation indistinct. Kidney: thick, little longer than its base and half again as long as pericardium; apical (right) limb weak; basal (left) point produced between pericardium and ureter. Ureter: "primary" region swollen and U-shaped with left arm produced beyond pericardium; terminal loop short and ventral to kidney; "secondary" continuation slender and less than half length of lung.

Genitalia (pl. 6, figs. 5 and 7): male organs well developed; uterus and albumen gland slender. Ovotestis: consisting of a few, large, long-clavate alveoli, imbedded in lower two-thirds of liver; duct very long, swollen and con-

voluted near its lower end; talon clavate, with a slender appendix. Uterus: apical end with two sacculate enlargements. Free oviduct: short and slender. Spermatheca: sac clavate, imbedded near columellar side of uterus; stalk medium in length, almost columellar in position to near base of uterus. Vagina: exceptionally long, swollen near middle. Prostate: long type, covering all of outer surface of uterus. Vas deferens: caught into penioviducal angle by tentacular retractors. Epiphallus: elliptical, with small lumen; wall thickened asymmetrically and marked by radiating, glandular columns; penial papilla short and conical, forming a slight, lateral projection near apex of penial lumen. Penis: exceptionally large, with two apical appendices ("flagella"); penis proper long fusiform, wall longitudinally plicate internally from apex to thick-walled swelling; larger appendix an ellipsoid continuation of penis proper, with thick, glandular wall; smaller appendix ovoid, with muscular wall, which develops two internal pilasters, opening into penial apex on side opposite vas deferens. Penial retractor: heavy and short; origin from diaphragm; insertion on apex of larger appendix. Cloaca: as in *costaricensis*.

Columellar muscle: similar to that in *R. bactricola*, but buccal muscle is almost free, left and right common retractor arise simultaneously (although right one does not subdivide until near buccal mass) and both right ocular and right muscle to inferior tentacle pass through penioviducal angle and between descending and ascending limbs of vas deferens. Jaw: similar to that in *R. bactricola;* 21 plates counted. Radular formula (pl. 6, fig. 1): 9-12-1-21; 91 transverse rows counted. Central: slightly smaller than first lateral and tricuspid. Laterals: asymmetric, bicuspid (entocone absent); outer teeth becoming shorter. Marginals: shorter and broader, but not sharply demarcated from laterals; ectocones more numerous but variable; entocone always absent.

R. abietum has the shell-sculpture of a *Radiodiscus* and

probably is more closely related to that group than any other. Nevertheless, its extreme anatomical divergence would warrant the erection of a new genus. Especially peculiar features of the new monotypic subgenus, *Radiodomus*, are: (1) its exceptionally long "primary" ureter, (2) its spermatheca which is of the short type and almost columellar in position, (3) its two penial appendices (flagella) and (4) the complete absence of entocones from its radula. This last feature, taken by itself, would transfer *Radiodomus* to the Endodontinae, but I believe it is more than counterbalanced by the primitive kidney and jaw, which are most like those in *Radiodiscus* and the other Helicodiscinae.

TYPE OF ANODONTITES BRUGIÈRE

BY WILLIAM B. MARSHALL

U. S. National Museum
United States National Museum

Thiele, 1909 (Nachr. deutsch. Malak. Gesell.), and Ortmann, 1911 (NAUTILUS, Vol. 25, pp. 88-91), did a real service to students of South American malacology in reviving Bruguière's generic name *Anodontites* (Journ. de Hist. Nat., Vol. 1, pp. 103-109, pl. 8, figs. 6, 7, 1792), proving that it is a perfectly valid name, and takes precedence over Gray's name Glabaris (Proc. Zool. Soc. London, p. 197, 1847).

The type of *Anodontites* is *crispata* Brug (l. c.). That has been settled beyond a doubt. Ortmann, 1921, "South American Naiades" (Mem. Carnegie Museum, Vol. VIII) gives a detailed description and a number of figures of what he took to be *A. crispata* Brug. Unfortunately his identification was incorrect. The specimens he figured are *Anodontites colombiensis* Marshall, 1922 (Proc. U. S. Nat. Mus., Vol. 61, p. 7, pl. 1, fig. 5, pl. 2, figs. 13, 14, pl. 3, figs. 5, 13, 14.)

The sculpture of *A. colombiensis* is very peculiar, being much wrinkled like dried paint, and arranged in a more or less radial pattern. This peculiar sculpture and the specific name *crispata* which very well describes it probably led Ortmann into his error.

The true *Anodontites crispata* has a radically different sculpture, arranged in distinctly radiating bands of beautifully regular, closely-set festoons, so disposed that they form also a concentric sculpture. Almost exactly this style of sculpture is found also on *Diplodontites cookei* Marshall, from Colombia (Proc. U. S. Nat. Mus., Vol. 61, p. 2, pl. 1, figs. 1, 3, 7, 8, 10, pl. 3, fig. 4, 1922); *Nephronaias reticulata* Simpson, from Honduras (Proc. Acad. Nat. Sci. Phila., p. 77, pl. 2, fig. 3, 1900), and on *Nephronaias elvae* Walker, from Nicaragua (NAUTILUS, Vol. 38, p. 52, pl. 1, 1924). The type of sculpture of these four species is believed to be the most delicate and perhaps the most beautiful displayed by any of the pearly fresh-water mussels. It is an interesting fact that, so far as known to the writer, this style of sculpture is found only in naiades from the region which includes the northern edge of South America, Honduras and Nicaragua. For some years I thought it was but a periostracal character, but at least one of them, *D. cookei*, shows it to be sculptural, i. e. in the calcareous matter; and this sculpture shows in the periostracum which is tightly applied to the shell. This was proved by removing the periostracum of one-half of a valve of *D. cookei* by immersing it in hot caustic potash solution which destroyed the periostracum, leaving the shelly matter beneath pure white but showing every detail of sculpture just as it appeared with the periostracum in place. The same treatment of *A. colombiensis* proved that its peculiar surface resembling wrinkled dried paint is likewise structural and not merely periostracal.

Ortmann, (1921, l. c.) says the type locality of *A. crispata* is South America. Perhaps he had not seen Bruguière's paper. In that paper Bruguière distinctly says

the shell came from streams in Guiana. He uses this sentence: Cette coquille habite dans les rivières de la Guyanne, d'ou elle m'a ètè envoye par M. le Blond. The shells figured by Ortmann as *A. crispata* came from the Rio de la Paila, a tributary of the upper Rio Cauca of the Rio Magdalena drainage. This is a long distance from Guiana, there are high mountains between and the drainage of Guiana has no connection with the Magdalena system.

INHERITANCE OF DIRECTION OF COIL IN ACHATINELLA

BY OLAF OSWALD

On a collecting trip to the Waiawa-Manana ridge, Oahu, on April 13, 1929, I found a total of 152 shells of *Achatinella swiftii,* of which 78 were sinistral and 74 dextral. One of these sinistral specimens contained a dextral embryo. This colony was about half-way down the southerly slope of the ridge. On the northerly slope, in a ravine about 150 yards directly opposite, I found 40 specimens, all dextral. A couple of hundred yards *makai* (seaward) from this second colony I collected 28 shells, all sinistral. The colonies on the southerly and northerly slopes were separated by a heavy growth of *uluhi* (*Gleichenia dichotoma*) fern, well known to collectors as an isolator of Achatinella.

On April 27th, at a point on the south slope of the southerly Waiawa ridge, almost directly opposite and about 3/8 mile northerly from the above localities, I found altogether 48 specimens, divided 41 dextral and 7 sinistral. Two of these sinistral animals had each a dextral embryo. In at least three instances, in this particular colony, I had the rare experience of gathering one dextral and one sinistral full grown specimen of one species from a single leaf. These also were *Achatinella swiftii.*

At Punaluu Valley, on the opposite (easterly) side of the island of Oahu, I found recently a colony of *Ach. bulimoides*

obliqua, in one dextral animal of which was a sinistral embryo. Incidentally, a few yards distant I collected one pure white shell of *Ach. decipiens kaliuawaensis* (dextral), the animal of which yielded four (4) dextral embryos. You will appreciate the rarity of this, knowing that an animal of the genus Achatinella bears ordinarily but one young, although occasionally two are found. The latter specimens have been given to the Bishop Museum.

Dr. Cooke informs me that he has noticed in several instances a different coil in the embryo from that of the mother.

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FOSSIL MOLLUSKS AND OTHER INVERTEBRATES FROM THE HUDSON RIVER TUNNEL, NEW YORK AND NEW JERSEY

BY HORACE G. RICHARDS

University of Pennsylvania

About 1906 some bluish mud containing shells taken from the Pennsylvania Railroad tunnel under the Hudson River connecting New York City, N. Y. and Jersey City, N. J. was sent to Dr. Amos Brown, then professor of Geology at the University of Pennsylvania. Dr. Brown turned over the material to Dr. Burnett Smith who was then on the staff of the department. However before Dr. Smith could complete his studies on the shells he was called to Syracuse University, and consequently the material was turned over to the Geological Department of the University of Pennsylvania. Through the kindness of Dr. Smith, now associated with the New York State Museum at Albany, N. Y. and Dr. Frederick Ehrenfeld, head of the Department of Geology of the University of Pennsylvania, I have been permitted to examine this material.

Very few species are represented, and many of these only by fragments, but it is thought worth while to report these specimens even after the lapse of so many years.

The material was stated to have come from 90 feet below the bottom of the river, but no information is available concerning the part of the tunnel from which the material was collected.

The following species are represented:[1]

Mytilus edulis (unusually thick shells).
Arca transversa Say.
Mactra lateralis Say.
Abra aequalis Say.
Crepidula fornicata L.
Alectrion trivittata (Say).
Polinices lactea Guilding.
Odostomia impressa var. *granitina* Dall.
Spine of *Arbacia.*
Balanus eburneus Gould.
Panopeus herbstii M.-Edw.

P. lactea and *O. impressa* var. *granitina* are now restricted to southern waters, and *A. aequalis,* although reported as far north as Connecticut is more common toward the south; the other species are all to be found living in the waters today.

Because of the insufficient data concerning the exact locality of the shells, and because of the complexity of the geological formations at the mouth of the Hudson River, it does not seem possible to date the fossils accurately except to say that they are probably from some part of the Pleistocene. The presence of the two southern forms might be taken as an indication that they belong to an interglacial warm stage.

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[1] I am indebted to Mr. E. G. Vanatta of the Academy of Natural Sciences of Philadelphia for help in the identification of certain of these specimens.

NEWFOUNDLAND SHELLS

BY E. G. VANATTA

The following species of shells were picked from leaf-mould collected by Mr. Bayard Long while on a botanical expedition to Newfoundland during July and August, 1929. It is hoped that the list will be a useful addition to the records published in THE NAUTILUS, Vol. 38, p. 92, and Vol. 40, p. 112. The *Helicodiscus* and *Vallonia* were not found on Mr. Long's former visit to the island. All the specimens are in the collection of The Academy of Natural Sciences of Philadelphia.

Helix hortensis Müll. Tucker's Head, Lord and Lady Cove, above Lomond, and Summit of Killdevil Mountain, Main Arm of Bonne Bay. Southern Arm, Bonne Bay. Deer Arm, Bonne Bay. Pointe Riche, Ingonachoix Bay. Hannah's Head, Bay of Islands, Newfoundland.

Zonitoides arborea Say. Near Pointe Riche and Hannah's Head.

Retinella hammonis Str. Tucker's Head, near Pointe Riche, Hannah's Head. Penguin Head, Middle Arm, Bay of Islands, Newfoundland.

Vitrina limpida Gld. Near Pointe Riche.

Euconulus fulvus Drap. Tucker's Head and Hannah's Head.

Gonyodiscus cronkhitei Nc. Tucker's Head, near Pointe Riche, and Hannah's Head.

Gonyodiscus cronkhitei Nc. var. anthonyi Pils. Pointe Riche. Grassy Island, St. John's Bay.

Helicodiscus parallelus Say. Hannah's Head.

Punctum pygmaeum Drap. v. minutissimum Léa. Tucker's Head, near Pointe Riche, and Hannah's Head.

Succinea avara Say. Tucker's Head, Pointe Riche, and Penguin Head.

Succinea ovalis Say. Tucker's Head, Lomond, and Hannah's Head.

Succinea verrilli Bld. Main River, and Lomond. Near Old Port au Choix, St. John's Bay, Newfoundland.

Cochlicopa lubrica Müll. Tucker's Head, near Pointe Riche, Hannah's Head, and Penguin Head.

Pupilla muscorum L. Tucker's Head, and near Pointe Riche.

Vertigo modesta Say. Tucker's Head, and near Pointe Riche.

Vertigo coloradensis Ckll. Tucker's Head, and Hannah's Head.

Columella edentula Drap. Tucker's Head.

Vallonia albula St. Tucker's Head, near Pointe Riche, and Penguin Head.

Lymnaea palustris Müll. Deer Arm, Bonne Bay. Near Old Port au Choix, and St. John Bay.

A NEW HELICINA FROM NEW CALEDONIA

BY T. D. A. COCKERELL

Among the various species of *Helicina* collected in New Caledonia in 1928, there is one which seems exceptionally distinct.

HELICINA (PALAEOHELICINA) OUENENSIS, new species.

Shell with max. diam. 5.6, alt. nearly 4 mm.; spire rounded, obtuse; periphery obtuse; aperture 3 mm. high; lip white, reflected; callus thin, not prominent. Surface with delicate revolving striae, easily seen under a lens, not confined to the last whorl. Color pale pinkish, with a broad dark brown-pink band above the periphery; on the last whorl above this band, the surface is pale straw color, faintly flushed with pink, with a slight tendency to be flecked with whitish; umbilical region broadly creamy white; interior of aperture deep brownish pink. Operculum not known.

Dge, Ile Ouen (also spelled Uen), Southern New Cale-

donia (*Cockerell*). Type in Philadelphia Academy. The widely distributed *H.* (*Palaeohelicina*) *primeana* Gassies is considerably larger (diam. 7 to 8 mm.) and the dark band above the periphery is olivaceous, according to Anton Wagner. In the Australian Museum at Sydney I saw specimens labelled *H. primeana*, and noted that they were quite large with or without a broad rosy band below periphery.

H. (*Aphanoconia*) *laeta* Crosse, as figured by Crosse is pale pinkish, with a red band, but it distinctly shows the *H. gallina* type of markings, and has a diameter of 9 mm. Also the red-brown band is a little below the periphery, instead of above it. It came from Mt. Mou, and Wagner's *H. laeta* from Prony Bay, diam. 11, alt. 7 mm, may be distinct.

Related species occur in New Guinea, the Moluccas, etc. The type is No. 149874 ANSP.

CORRESPONDENCE

To Friends and Readers of THE NAUTILUS:—

Once more I am in Mazatlan, classic locality of Carpenter's paper on West Mexican shells. I have been in Mexico three weeks, on my way south on a conchological expedition. I had eleven quite profitable days at Guaymas, during the early January tides, walking from three to eight miles per day. The entire bay is either mud flats or rocks and mud, no sand beaches except on the outer Gulf coast. At one small point of rocks on the inner bay, about two miles from town I located a school of very fine *Fusinus colpoicus* Dall, ovipositing on the inner surfaces of dead Crucibulum shells. Two small species of Chitons were taken on the rocks in the bay, also that very interesting species *Paramentaria duponti*, which looks like a small Conus, but belongs to the family Columbellidae. In a small cove on the island on which is the inner lighthouse, I located a colony of fine *Murex radix* and *M. bicolor*, burrowing in the mud entirely below the surface. These were all fine, perfect

specimens, not worm-eaten like the average ones found on the surface of the rocks. It certainly took a lot of determination to select only two dozen of the finest and give the rest, about six dozen, to my boatman who calls them *"burras"* and said they were *"muy bueno para comer"*, which applies equally well to any kind of mollusks large enough to eat. On one of the other islands we founds some giant Pinnas, nearly twenty inches long. In La Paz these are called *"hacha"*, but here they are served for food as *"callos"*, and are really very good eating. The large central muscle only is used and is very sweet and tender, like the large scallops on the Atlantic coast of the United States. Here in Mazatlan they are used in large numbers for food, great reefs of empty shells being piled on the mud flats, literally hundreds of thousands of them, with hardly a perfect one to be found.

The Guaymas oysters are justly famous both for their size and delicious flavor. They are served at every meal at the restaurants, and can be bought from carts at one's door, where they are opened to order at only 25 centavos (12½ cents) per dozen, some of the shells being eight and ten inches in length. They are gathered outside in the Gulf near the mouth of the Rio Yaqui, so there is no danger of infection. I tried dredging for two days with a launch or "gasolena" as they call them, outside the lighthouse, with fair results on sand and broken shell bottom. The inner bay is all mud bottom.

Stopped off at San Blas and took a sixty mile auto trip to the coast at Topolobampo. The road runs the whole length of the Rio Fuerte valley through the great sugar and winter vegetable section of Los Mochis. The marine species taken were much the same as at Guaymas, however, the chitons here seem to be another species. A small Bulimus about an inch in length and an interesting Polygyra (much resembling the *P. cereolus* in (Florida) were found under rock piles on the steep hill slopes around the bay.

All the Mollusca found within several miles of Mazatlan, are as soon as large enough destined for the soup pots. The

smaller species are not disturbed so I had good luck with these and also collected five species of beautiful chitons. The large *Chiton petholatus* Sby. is used extensively for food and is called "carachas". Some grow to over three inches in length. My best collecting was done on the small islands off the coast, I tried a combination dredging and shore collecting trip in a launch to the Islas de Venado. My greatest thrill was in getting three fine living specimens of the giant *Malea ringens* under rock ledges on the windward side of the island. The animal is coal black. The natives call them "calaveras" from their fancied resemblance to a skull. I got my first giant Patella (*Ancistromesus mexicanus*) here also. They are surely hard to find, as they are hunted for food much like the Haliotis on the California coast. They also live on the outer side of the islands and are found only at extreme low water when there is not too much surf and are usually so covered with moss that they look like part of the rock to which they cling.

We also visited the island of the Light House or "Faro" and found more of the giant limpets or "*Lapas*" as they are called here. All the small species are called "*Lapas chicas*" and are all used for food. The young shells of the giant Patella look much like some of the handsome South African species. I had never seen the young shells before and at first glance, thought they were another species. On this island the fine *Leucozonia cingulata* were depositing their eggs under rocks on the windward side of the island. Some very fine *Patellipurpura patula* and *Thais biserialis* were also taken at the same place. The *P. patula* gives off when disturbed, several drops of a milky liquid which quickly turned the collecting sack a metallic green and within half on hour this changed again to a royal purple, which is a fast dye and cannot be boiled out. I suppose it is akin to the "Tyrrian purple", mentioned in history as used by royalty exclusively.

From the lighthouse on the top of this island 170 meters above the water there is a wonderful view of the whole

Mazatlan coast and the mountains in the distance. Two interesting species of small land shells were found under leaves on the thickly forested sides of rocky islet. A small point of rocks in the inner bay, near "Campo Santo", last year at this time yielded some of my choicest treasures—Mitras, several fine species of Pleurotoma and the beautiful *Murex lappa* Brod. This year the hermit crabs had changed their fashions in wearing apparel and nothing more elaborate than Cerithiums were to be seen. It simply wasn't being done this season in the best society of Mazatlan crabs.

HERBERT N. LOWE.

Mazatlan, Mexico,
February 4, 1930.

NOTES AND NEWS

THE DEATH OF DR. J. COSMO MELVILL on November 4, 1929, at the age of 84 years has been announced.

CORRECTIONS.—Through an unfortunate typographical error the name of a new snail from Kern County, California, described by the writer in the October NAUTILUS (v. 43, p. 40), is given as *Helminthoglypta tudiculata kermensis*. The proper spelling of the geographic trinomial is of course *kernensis*.—S. S. BERRY.

On page 16 of the July number, for William J. Clinch, read William J. Clench.

In the January issue of THE NAUTILUS, page 104, the ninth line in the note "Zoogenites and Carychium in Colorado" was inserted as the third line from the bottom of the note "Pododesmus macroschismus Deshayes".

PLANORBIS SILICEUS Brown and Pilsbry, Proc. Acad. N. S. Phila., 1914, p. 212, proves to be a homonym of *Planorbis siliceus* Eichwald, Lethaea Rossica III, 1853, p. 298, as I am informed by a friendly letter from Dr. W. Wenz. *P. siliceus* may now be called *Planorbis amosbrowni*, after my friend and collaborator of former years.—H. A. PILSBRY.

DR. BENEDIKT DYBOWSKI, professor of zoology at Lwow University, died on February 1, at the age of ninety-five years. After being exiled to Siberia for participating in the 1863 insurrection in Poland he undertook a study of fauna from Lake Baikal to Kamchatka. He is chiefly known to conchologists for his work on the Lake Baikal mollusks.

PROFESSOR T. D. A. COCKERELL expects to go to the Atlas Mountains during the coming summer.

THE UNIVERSITY OF COLORADO MUSEUM has added over 1,000 species and subspecies of mollusks to its collection during the past year. The most notable single addition is a set of Hungarian shells, arranged for through Dr. Soós, of the Museum at Budapest. Three shipments aggregating 385 species and subspecies have been received and more are yet to come.

GENDER IN GENERIC NAMES.—The generic terms, *Haplotrema Helisoma* and *Zonitoides*, two of which have but recently come into common use, are often incorrectly treated as if they were of feminine gender.

Haplotrema Ancey (1881, Le Nat. 1: 453) is derived from two Greek words: *haplos* (simple) and *trema* (foramen), of which the latter is a neuter noun. Adjectives used as specific names should take the neuter form (e. g., *concavum, vancouverense, occidentale*, etc.) although substantives used in apposition remain unchanged (e. g., *sportella*, a little basket).

Helisoma Swainson (1840, Mal. : 337) is also constructed from two Greek words: *helo* (to twist) and *soma* (body) and is likewise a neuter noun, although its author carelessly used it as if it were feminine. Adjectives used as specific or subspecific names take neuter endings, such as *corpulentum, campanulatum, chautauquense*, etc. But, *trivolvis*, which is actually a plural ablative and can only be used for a specific name if considered an arbitrary combination of letters, had best remain unchanged.

Zonitoides Lehmann (1862, Mal. Bl. 9: 111) is an adjec-

tive of Greek form which is employed as a Latin patronymic, which would be masculine. It was so regarded by its author, who derived his term from one masculine substantive (*Zonites*) and used it as another (e. g., *Z. nitidus;* also *arboreus, lateumbilicatus,* etc.; but *Z. acerra*).—H. BURRINGTON BAKER.

UNIO SPINOSA Lea.—In the Macy-Masius reprint of the "Travels of William Bartram", 1928, page 345, is mention of a "large kind of muscle in the sand; the shell of an oval form, having horns or protuberances near half an inch in length and as thick as a crow quill, which I suppose serve the purpose of grapnels to hold their ground against the violence of the current." The locality was the Mississippi River, not far above New Orleans. Quoting this apparently from the Philadelphia edition of 1791, which seems to be somewhat different from the text of the reprint, Lea comes to the conclusion that his *Unio spinosa* occurs both in the Altamaha River of Georgia and the Mississippi River of Louisiana. It is highly improbable, of course, that *U. spinosa* ever inhabited the Mississippi. Judging from his work, Bartram wrote not from a journal, but from memory. He crossed the Altamaha first in 1773. He was at Frederica at the mouth of the river in 1774. Four years later, he twice crossed the stream and at the part where the shell is reputed to live. It was thirteen years after that before his experiences were printed. It is reasonable to assume that Bartram, depending upon his power of recollection, confused what he had seen in eastern Georgia with things that met his eye in southern Louisiana.—CALVIN GOODRICH.

THE HUMPHREY COLLECTION.—Mr. Edward G. Humphrey of Somerville, Mass., for a number of years Secretary of the Boston Malacological Club, informs me that his collection of shells is going to Dartmouth College. It is a general collection of over 8,000 species. Rich in genera and containing many of the large and handsome species, it is well adapted for a museum and will form a beautiful synoptic collection. Mr. Humphrey is a Dartmouth man, Class of

'77. We congratulate him in having his collection go to his own college.—C. W. J.

PLEUROCERA (STREPHOBASIS) CURTUM (Haldeman).—Dealing with this species in a paper on *Strephobasis* (Occas. Papers Mus. Zoology, Univ. Mich., 1928). I spoke of its having been found sub-fossil in Wayne County, Ky., more than one hundred feet above the present level of the Cumberland River. The inference was that the mollusks had retained their specific characteristics in the long period in which the river had greatly deepened its channel. For the purpose of straightening out the record, it should be said that Professor George M. Ehlers, who originally collected the specimens, went over the ground again in the summer of 1929 and came to the opinion that the shells were not water-borne, but had been carried up the banks by Indians for use as food.—CALVIN GOODRICH.

THE GIANT CLAM (TRIDACNA GIGAS).—Having occasion recently to speak of the habits of the giant clam, I could find comparatively little bearing on the subject. The following note by Geoffrey Tandy in the "Natural History Magazine" (British Museum), vol. 2, p. 91, 1929, may therefore be of interest:—"The giant clam is something of a fraud. It is said, there is no reason to think untruly, that walkers on reefs have put their feet into the shell and have been held until the incoming of the tide and consequent death by drowning. But the animal seems always anxious to close before anything approaches him and is, moreover a plankton feeder. It would, I feel, be next to impossible to become trapped unless one was wading waist-deep, and even then it would be very bad luck."—C. W. J.

LAND SNAILS FROM THE SAN JUAN ISLANDS, WASHINGTON.—During a very brief visit in September, 1929, Mr. Erval J. Newcomer collected shells of a number of terrestrial snails on islands of the San Juan Group in Puget Sound, and as one species and a subspecies originally described from Vancouver Island are here shown to belong on this side of the boundary as well, the brief list of deter-

minations is thought to be of sufficient interest for publication.

Sta. I, under rocks, English Camp, San Juan Island.

Monadenia fidelis (Gray).

Polygyra columbiana (Lea), a rather small form of the species.

Polygyra cf. *germana* (Gould), a single fragmentary specimen.

Euconulus fulvus (Müller).

Pristiloma cf. *lansingi* (Bland), a single immature example.

Microphysula cookei (Pilsbry), a single living specimen. Dr. H. B. Baker has already called attention to the apparent close relationship existing between this interesting species and the Rocky Mountain *ingersolli* (Bland).

Retinella cf. *binneyana* (Morse), a single imperfect specimen.

Haplotrema vancouverensis (Lea), juv.

Sta. II, Friday Harbor, San Juan Island.

Polygyra columbiana (Lea).

Haplotrema vancouverensis (Lea), juv.

Sta. III, under rocks and logs, 3 miles east of Anacortes, Hidalgo Island.

Polygyra columbiana (Lea).

Polygyra germana vancouverinsulae Pilsbry and Cooke. The single specimen obtained is even more umbilicate than the typical Vancouver Island material I have seen, but seems hardly separable taxonomically as matters now stand.

Haplotrema vancouverensis (Lea), 4 examples.

Haplotrema vancouverensis hybrida (Ancey), 2 examples.

S. S. Berry, Redlands, Cal.

Giffordius pinchoti n. g., n. sp.—Polygyroid, umbilicate, with convex spire of about 5 whorls; cinnamon-brown, with microscopic sculpture of wrinkles along growth lines and more retractive coarse, irregular threads. Lip reflected, with a small basal tooth and an oblique parietal tooth. Alt.

4, diam. 7 mm. *G. corneliae* n. sp. Similar but without the coarser threads, toothless; 4½ whorls. Alt. 4, diam. 7.4 mm. Both from Old Providence Island.—H. A. PILSBRY.

PUBLICATIONS RECEIVED

SHELL LIFE. By Edward Step. (Frederick Warne & Co., London and New York. 1927. $3.00.) Pp. 1-421, pl. 1-32, with many text figures. A book written in a popular way pertaining to the shells of the British Isles. This is an excellent piece of work, figuring all of the common species and many of the rarer forms, many in color. The style is very easy to read with considerable information about the characters, ecology and distribution of the British forms.—W. J. CLENCH.

A DESCRIPTIVE CATALOG OF THE MOLLUSCA OF UTAH. By Ralph V. Chamberlin and David T. Jones (Bull. University of Utah, XIX, No. 4, 1929, pp. i-x, 1-203). This paper is intended to serve as a basis for further scientific work and as a guide to teachers of zoology and amateur collectors of Utah mollusks. The introduction discusses the faunal relations, problems remaining for solution, and the collection and preservation of specimens. The number of state or regional publications recently appearing on the Mollusca speaks well for the progress that is being made in the study of our fauna, and for the growth of interest which creates a demand for such literature. In this catalogue 118 species and varieties are described and most of them figured, with their distribution in Utah fully treated; the following being described as new:

Ogaridiscus (new genus, for *Hyalina subrupicola* Dall.)

Pupilla stoneri, Cedar Canyon.

Carinifex atopus, Bear Lake.

The map showing collecting stations should stimulate field workers, as there are some large blanks waiting to be filled up.—H. A. P. and C. W. J.

THREE NEW LAND SHELLS OF THE GENUS OREOHELIX FROM ARIZONA. By William B. Marshall. (Proc. U. S. Nat. Mus., vol. 76, No. 2802, 1929.) *Oreohelix yavapai vauxae, O. houghi* and *O. h. winslowensis* are described and figured.

A HERMAPHRODITIC VIVIPAROUS OYSTER OF THE ATLANTIC COAST OF NORTH AMERICA. By J. S. Gutsell. (Science, Nov. 5, 1929.) *Ostrea equestris* Say at Beaufort, N. C., shows alternate overlapping hermaphroditism as in the European *O. edulis*. It was found growing on scallops in profusion.

SOME INTRODUCED MOLLUSCS. By F. R. Latchford. (Canadian Field Nat., vol. 44, p. 33, 1930.) *Helix nemoralis* is recorded from Owen Sound, Ontario, and *Lymnaea auricularia* and *Valvata piscinalis* from Toronto.

LORRAINE SCREVEN FRIERSON, A SOUTHERN CONCHOLOGIST. By John K. Strecker. (Contrib. Baylor Univ. Museum, No. 21.) Sketch of the life and activities of this naturalist, with a bibliography of his scientific writings.

THE GENUS ALOPIA. By L. Soos. (Ann. Mus. Nat. Hungarici XXV, 1928.) A critical study of this intricate Carpathian group of Clausiliae, which live exclusively on limestone exposures. The existence of "amphidrome" species is discredited, dextral and sinistral forms otherwise nearly similar being considered distinct specifically.—H. A. P.

PSEUDOHYALINE AMERICAN LAND SHELLS. By H. Burrington Baker. (Proc. Acad. Nat. Sciences Phila., vol. 81, pp. 251-266, 1929.) Another of the author's valuable papers on the small land shells. The anatomy of some of the species in the following genera: *Microphysula, Miradiscops, Zonitoides, Pilsbryna* and *Helicodiscus* is shown on two plates, a new section of *Zonitoides, Pseudohyalus* is proposed, genotype *Gastrodonta lateumbilicata*.

A SNAIL-COLLECTING APHIS-LION LARVA. By David T. Jones. (Marietta College Research Pub., vol. 1, pp. 1-9, 1929.) This larva attached to its back the shells of *Punctum pygmaeum, Enconulus fulvus* and *Striatura milium*.

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